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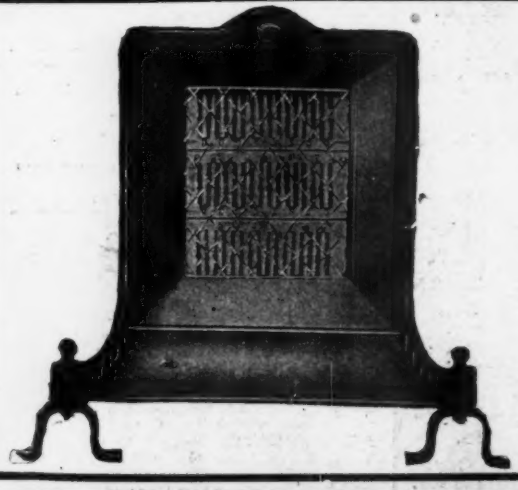

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ELECTRICAL REVIEW.

VOL. LXXXVII. NOVEMBER 5, 1920. No. 2,241.

ELECTRICAL REVIEW.

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A NEW ACTIVITY FOR THE WHITLEY COUNCILS.

Up to the present the Joint Industrial Councils for the Electricity Supply Industry have confined their attention to certain concrete questions—rates of wages, working conditions, and so forth. This, of course, is quite fitting. The first demand on the Councils is naturally that they should settle the wherewithal to live. Further, this will always be one of their chief duties. But it is not their *end*. Their fundamental purpose goes much deeper than this. They are not there merely to settle differences or disputes. The Whitley scheme establishes the Industrial Councils as a kind of meeting ground where employer and employed may join forces in working for the good of the industry, and collaterally for the good of everyone concerned in it. The purpose of the Industrial Councils is to secure the attainment of a permanently friendly relationship in working, between the two. The basic idea is that employer and employed so meeting shall gradually eliminate their differences. It assumes (and no one will ever understand the Industrial Council system unless this is constantly borne in mind) that *the interests of employer and employed can be made identical*; that the present opposition between employer and employés, capital and labour, is an artificial one, brought about by misunderstanding, ignorance of true economic ideals and principles, and selfishness. This is the Whitley idea, a buoyantly optimistic one perhaps, but the only salvation for industry, if the Report is to be believed.

Anyhow, this is the idea which the electricity supply industry has set itself to work out in instituting this system of Industrial Councils. It is, therefore, obvious that progressive intimacy between the two sides is one of the first things involved. This, of course, will be brought about to some extent by the mere fact of meeting week by week. But might not this ideal of mutual understanding be hastened, by discussion of first principles, and by discussion of aims? It is an intellectual understanding that is necessary—mere handshaking geniality is as obsolete and as ineffective as ordering "beer all round." Let each side say what it regards as fundamental principles. Let each side say what it is really aiming at. This has never been done as yet; in fact, until these Industrial Councils came along there was no opportunity. Now there is an unparalleled opportunity. None could be better.

Both sides have to meet periodically to transact actual concrete business. Why, when this is over, might not the meeting be prolonged into an appendix, as it were, when *theory*, principles, aims, could be discussed, in the abstract? The time need be but short. If each side carried away from each meeting only one clear idea of what the other side was driving at, the aggregate mutual understanding gained would, in six months, be very considerable. And until there is mutual understanding it is impossible to get any approach even to mutual agreement. Again, the very impact of opposing opinions is mutually regulative, and the best brains will tell in the long run. Each side has a free field and no favour in an effort to convert the other. At present each side expends any amount of vocal energy in pointing out to its bosom cronies the errors of the opposite side. We hear one employer getting eloquent even to the point of apoplectic wrath, in expounding to another employer the Bolshevistic errors, the crass

stupidities, and so forth, of some one or other of the trade-union side. One might also hear, we presume, one trade unionist derisively tearing to pieces, to the sympathetic listening of a brother trade unionist, the last shreds of argument of the capitalist. Now with the same expenditure of time and breath, these arguments (properly and temperately marshalled, we would suggest) might be displayed for the consideration, not of a sympathiser, but of the opposite side. After all, there is only one way of dealing with an idea (whether it be socialism, syndicalism, or what not), and that is by setting up against it another idea. Employers very often talk of stopping revolutionary ideas as if one could wipe them out and leave a vacuum. One can only displace one idea by substituting another, and a better one. And nowhere could this be better essayed than in the Industrial Councils. In practice, our suggestion would work out that half an hour or an hour's meeting would take place after the business meeting. Some abstract proposition would be put before the meeting, and anyone would speak on it, say, for five minutes or whatever limit was fixed. The exact procedure would be a matter for experiment. But something of the kind might certainly amplify the present *régime* of the Councils, and would be fully in accord with and in fact distinctly further the ultimate objects for which the Whitley Councils were instituted.

The I.E.E New Session.

Next Thursday the new session of the Institution of Electrical Engineers formally will open with the presidential address of Mr. Ll. B. Atkinson, of whose career we give a brief account in this issue. That his period of occupation of the chair will be marked by all the features that go to make success we have no doubt, and the fact that one of his first official acts will be to propose an all-round increase in subscriptions will not be counted unto him as unamiable, for it has long been known that such an increase is inevitable, in view of the depreciation of the coinage. Unpopular as the change may be, it cannot be regarded as unreasonable, or unwarranted by the circumstances; and, as a matter of fact, it is much smaller than might well have been expected, in view of the increase in expenses. This tempering of the wind to the lambs of the I.E.E. is due to the large increase in membership, which enables the Council to meet the requirements with a scale of subscriptions much lower in proportion than the increased expenditure would otherwise have rendered necessary.

Particulars of the proposed new scale of subscriptions are given elsewhere in this issue. The Institution of Mechanical Engineers has already increased its scale of subscriptions, and the Institution of Civil Engineers is in course of doing the same. The release of the Institution Building, which is announced to take place early next year, will involve the loss of rent, which will throw a further burden upon the finances of the Institution.

It is interesting to note that in the circular-letter in which the Council announces the holding of a special general meeting to consider the amendment of the Articles of Association, the increase of membership is explicitly attributed to "the greater activities of the Institution," and reference is made to "the fact that its responsibilities and opportunities have been so much enlarged during the past few years," with the result that "membership of the Institution may now, more than ever, be claimed as a valued privilege." In past years we said hard things of the Council because it refused to follow the policy inaugurated by Dr. Ferranti, but as its attitude has more and more come into line with that policy, we have missed no opportunity of commending its progress towards the "broader" views. We have even been unjustly accused of hostility towards the Institution; but when it is considered that our efforts and criticisms were always directed towards its attainment of the position at the head of the whole industry which the Council now justly prides itself upon having reached, and that its increased prestige is ascribed to the adoption of the policy which we advocated, it cannot be denied that we acted in the true interest both of the Institution and the industry.

The Revival of Public Lighting.

In the present issue we publish the first of two articles on "Street Lighting," by Mr. Haydn Harrison, whose work in connection with scientific illumination is well known. The needs of safety during the war, and of economy after it, have checked this important branch of electrical work; but, as in the case of so many other scientific applications, we find that intensive study for war purposes has, in effect, resulted in developments which can now be placed at the service of the community.

There are but few engineers who do not realise that good public lighting is one of the best advertisements for electricity, and, in fact, it becomes a duty of the supply engineer to secure this business if possible, in order that every member of the public shall derive some direct advantage from the electricity supply, even if for the moment unable to introduce it into his home.

The new devices described by the writer of the articles bring home to the mind a peculiarity of almost all public lighting work—namely, that the problem to be met lies not in the proper illumination of plane surfaces of circular form, for which the lamp or light point is naturally adapted, but rather in the lighting of "grooves," more or less straight, and narrow in comparison with their length.

To an extent the difficulties of economical street lighting and uniform distribution have been met by the use of powerful lights at a considerable elevation, or of a much larger number of small lamps on short supports. In each case a very large proportion of the light emitted is wasted, and even where elevated lamps over the centre of the road are used, the difficulty with moving shadows cast by tall vehicles across the footpath is a serious one.

Any device which can in a practical manner collect all the light emanating from a lamp and redirect it in something approaching to a wedge-shaped beam should, together with the gasfilled lamp, produce a system of street lighting which will definitely add that sphere of usefulness to the many now occupied by electricity.

The Right to Work.

Under the heading "The Right of Every American — Working Freedom," the *American Machinist* quotes with approval, as reflecting "the thought of every real American," a recent speech by Mr. Harding, the Republican candidate for the Presidency:—

"No party is indifferent to the welfare of the wage-earner. To us his good fortune is of deepest concern, and we seek to make that good fortune permanent. We do not oppose, but approve collective bargaining, because it is an outstanding right, but we are unalterably insistent that its exercise must not destroy the equally sacred right of the individual in his necessary pursuit of livelihood. Any American has the right to quit his employment; so has every American the right to seek employment. The group must not endanger the individual, and we must discourage groups preying upon one another, and none shall be allowed to forget that Government's obligations are alike to all the people."

Pointing out that their ancestors came to the Western shores to seek religious freedom, our contemporary declares that Americans must not let their freedom of action be killed by those who insist that they must belong to a certain party or organisation in order to have the right to earn a livelihood or work for whom or where they please.

The point is further emphasised by an order of the U.S. Shipping Board, insisting on the principle "that proper longshoremen be given an opportunity to work on its vessels, regardless of affiliation with any particular organisation. No other position is compatible with equality of opportunity for employment, which must be preserved in the public service."

In the United States Trade-Union organisation is by no means so far advanced as it is in this country, where the tendency, as we have regretfully noted, is to ignore the primal right of man—his personal freedom.

ROTHERHAM ELECTRICITY WORKS.

(*Concluded from page* 551.)

The generating plant consists of two 12,500-KW. Parsons turbo-alternators, and one 30,000-KW. British Thomson-Houston set. The former were built for the Melbourne Suburban Railways, to the specifications of Messrs. Merz and McLellan, but were commandeered by the Government and diverted to Rotherham.

They are of the pure reaction type arranged with two cylinders in tandem, the H.P. cylinder exhausting at about atmospheric pressure into the L.P. cylinder. The portion of the H.P. cylinder which is subjected to the high-temperature steam is of steel, the rest of the casing being of cast iron. The L.P. cylinder is arranged so that the steam enters at the middle and flows towards both ends, and thence into the two condensers. This arrangement provides a turbine balanced for end pressure, and keeps the diameter of the shaft small.

The turbines are designed for a stop-valve pressure of 200 lb. gauge at 588° F., the superheat being 200° F.; vacuum, 28·4 in. at barometer 30 in., and speed 1,500 R.P.M. The guaranteed consumption is 11·5 lb. per KW.-hour at full load.

The alternator of each set is designed to generate at 6,600 volts, 50 cycles, at 0·75 power factor, three-phase, 12,500 KW. as normal full load, with an overload capacity of 25 per cent. for two hours, and 50 per cent. momentarily.

The stator windings are embedded in tunnels, and the end windings are firmly supported by wood packings and massive brass clamping plates, which strongly grip the windings and prevent movement on the occurrence of sudden short circuits.

The rotor is driven through a flexible coupling, and is built up of plates with radial slots for the windings. Steel caps hold the end windings in position.

Ventilation is effected by a separate "Sirocco" fan driven by a 110-B.H.P. motor (fig. 21). The exciter armature is driven through a flexible coupling from the end of the rotor shaft. There are two condensers on each set (fig. 17), which receive the exhaust steam from both ends of the L.P. cylinder, the main exhaust pipes leading to the condensers being connected together by a balancing pipe. The condensers are mounted on heavy coiled springs. The condenser cooling surface is

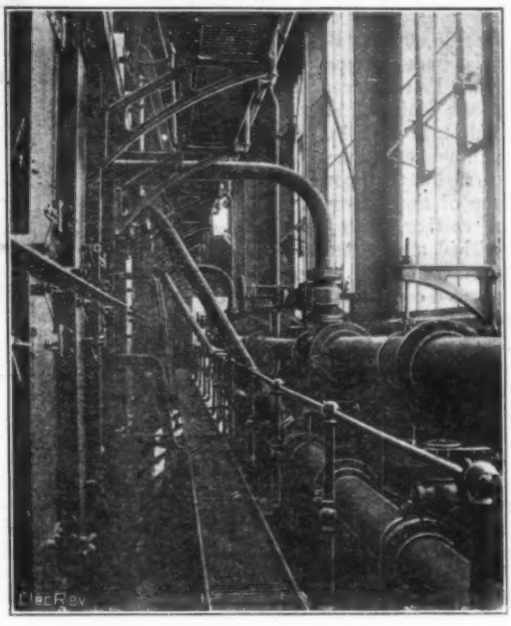


FIG. 15.—STEAM MAINS BEHIND THE BOILERS.

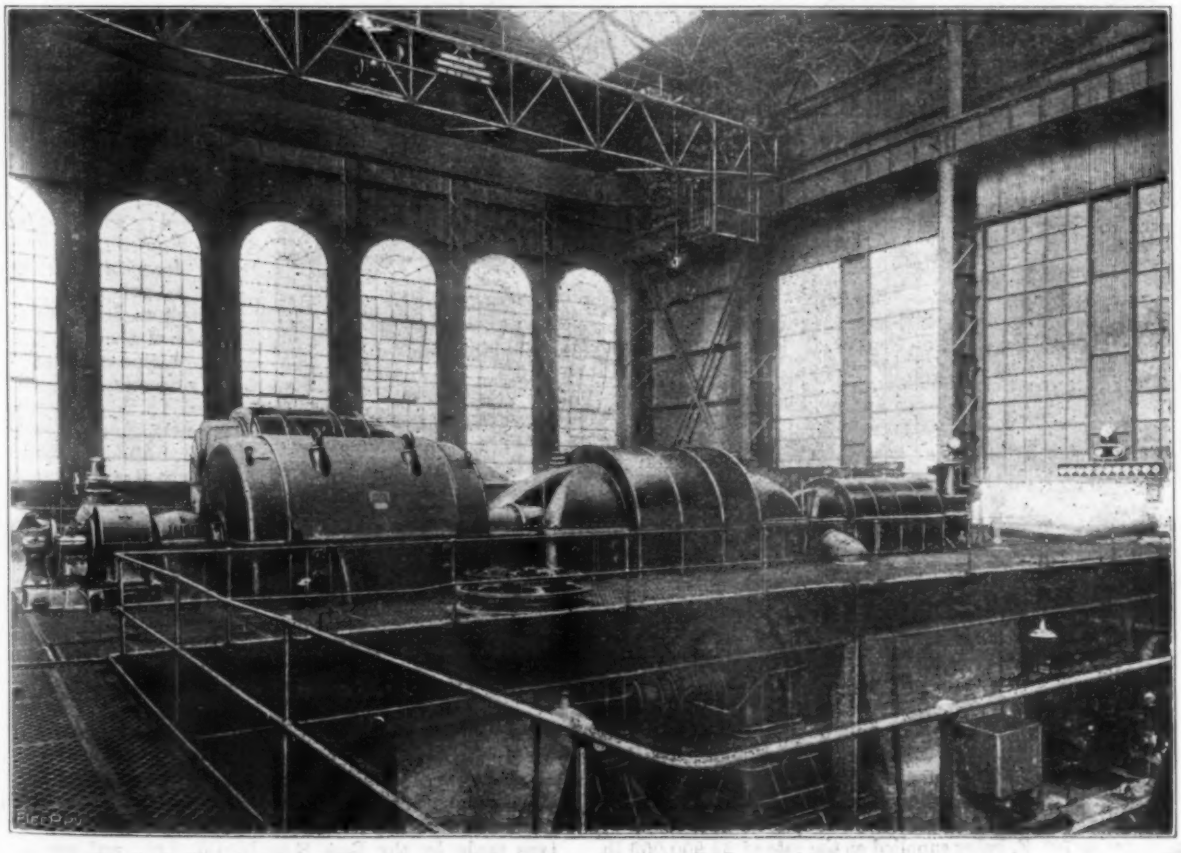


FIG. 16.—PARSONS 12,500 KW. TURBO-ALTERNATOR AND B. & W. 60-TON CRANE.

14,380 sq. ft., and the quantity of cooling water 19,200 gallons per minute at a temperature of 70° F.

The air pumps are of the Parsons totally enclosed reciprocating type, arranged for self-lubrication, and are driven through Parsons double-helical gearing by 40-B.H.P. motors. The small rotary pump for supplying oil to the various working parts is driven from the pinion shaft of the air-pump gearing. The whole air-pump is self-contained, and runs very quietly. The condensers are provided with the Parsons vacuum augmenter.

An auxiliary steam-driven oil pump is provided for each set for starting up, and is available in case of emergency.

The 30,000-KW. B.T.H. turbine is of the Curtis impulse type, and runs at 1,500 R.P.M. Its most economical load is 25,000 KW., at which load the guaranteed consumption is 11·1 lb. per KW.-hour. The maximum continuous load of 30,000 KW. is carried at 0·75 power factor. The stator frame of the alternator is a single hollow iron casting, with detachable panels of planished steel fitted to the outside, which give access to the interior. The winding, of formed copper bars, is carried in open slots and fixed in place with hardwood wedges; the bars are subdivided into sections which are transposed, to equalise the current distribution. The insulation in the slots consists of hard-moulded mica ⅛ in. thick. The end portions are secured to stout bronze rings. The rotor is built up of steel disks on a shaft, and the windings are held in the slots by steel and bronze keys. The insulation is of mica reinforced with fibrous material, and the end portions of the windings are held in stout steel rings. Both ends of the alternator are closed by shields, and fans at both ends of the rotor draw air in from below the bed-plate and force it through the machine, whence it is discharged through a duct in the foundations. The condensing plant was supplied by Messrs. Willans and Robinson, Ltd., as sub-contractors to the B.T.H. Co., and is capable of maintaining a vacuum of 28½ in. when dealing with 277,500 lb. of steam per hour, circulating water at 70° F. being supplied at the rate of 21,900,000 lb. per hour, or about 80 lb. per lb. of steam. Two condensers are provided to cope with this enormous duty, each having a cooling surface of 22,500 sq. ft.; the exhaust passage at the turbine end measures no less than 16 ft. × 8 ft., and is connected by a breeches pipe with the condensers. Separate circulating water pipes are provided for each condenser, with stop valves, so that either of them may be laid off for cleaning while the turbine exhausts into the other one; the cleaning will be effected by means of steam ejectors with the necessary piping to enable a cleaning solution to be circulated through the tubes. A separate dry-air-pump of the Willans-Edwards totally enclosed self-lubricating type, driven directly by a 60-B.H.P. B.T.H. motor at 100 R.P.M., is provided for each condenser, and is coupled to a common pipe, so that they can be used singly or together, with either or both condensers. Vacuum-augmenter jets are also installed, discharging into the same air pipe, but each air-pump is of sufficient capacity to deal with the air from both condensers during normal leaks without the aid of the augmenters. The condensate is removed by two Pulsometer extraction pumps coupled to 23-B.H.P. B.T.H. motors, and drawing from a bus-pipe; either pump is large enough to deal with the whole of the condensate from both condensers.

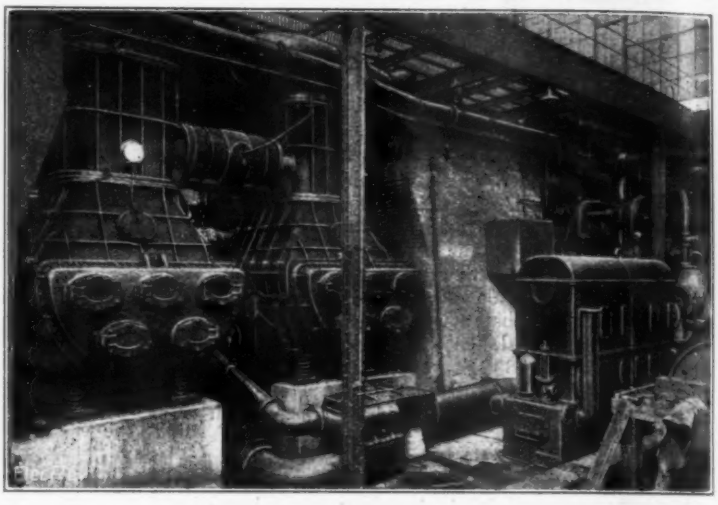


FIG. 17.—PARSONS CONDENSERS AND AIR PUMPS.

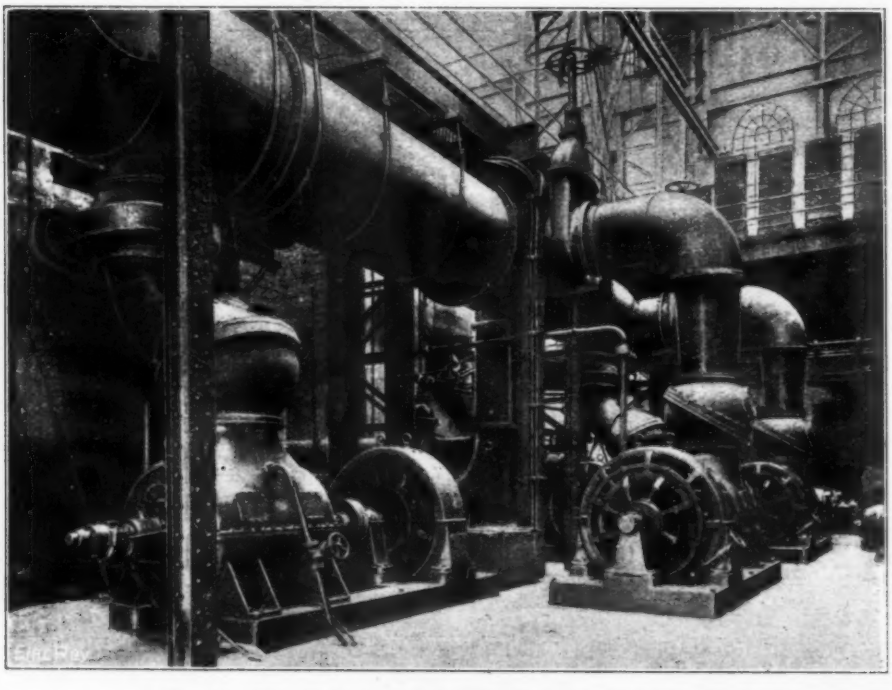


FIG. 18.—REES ROTURBO CIRCULATING PUMPS AND AITON PIPING.

Condensing water is derived entirely from the river Don, and is received through sluice gates into a sump, flowing through two Brackett revolving disk screens, 20 ft. in diameter. From the sump two culverts measuring 8 ft. 3 in. wide × 8 ft. 3 in. high carry the water under the whole length of the engine room; either culvert can be emptied for cleaning whilst the other is in use. A single culvert, measuring 10 ft. × 10 ft., on the other side of the engine room carries away the discharge from the condensers. Four circulating pumps are at present installed, two drawing from each culvert; they are of the self-regulating type made by the Rees Roturbo Co., Ltd., and are each capable of supplying 19,200 gallons of water per minute.

Each pump is driven by a B.T.H. motor of 510 B.H.P., running at 580-610 R.P.M. A rotary priming pump by the same makers, driven by a 12-B.H.P. motor, is provided. The circulating pumps all feed into a main bus-pipe, the diameter of which is tapered from 78 in. to 39 in.; from the bus-pipe the smaller condensers are fed through pipes 25 in. in diameter, and the 30,000-KW. set through 36-in. pipes, the discharge pipes being of corresponding diameters. The bus-pipe and part of the delivery pipes are constructed of mild steel plates $\frac{5}{16}$ in. thick; the flanges, branches, oil-switch room on the second. The control room is on the fourth floor.

On the ground floor are installed the earthing resistances for the generators, together with isolating oil-switches for the latter and for the outgoing cables; here also space is available for bus-bar reactances and switchgear, which are not at present required. On the first floor, in addition to the bus-bars, which are in duplicate, are the selector switches, operated by handles outside the compartments, and the instrument transformers. The bus-bars are carried

FIG. 19.—CONTROL ROOM.

longitudinal and circumferential seams are all electrically welded, the bus-pipe, it is believed, being the largest ever constructed in this country on this system. The remaining pipes are of cast-iron. Expansion joints of corrugated copper are provided in all the delivery branches, and valves operated from the engine-room floor are fitted in all pump delivery and condenser inlet pipes. All the circulating water piping was supplied by Messrs. Aiton & Co., Ltd., of Derby. Part of the huge 78-in. bus-pipe, being put on rail on Armistice Day, was conspicuously painted "The Pipe of Peace." Water for the glands of the circulating pumps and for the oil coolers is taken from the bus-pipe through duplicate filters, which are cleaned at frequent intervals.

The switchgear is housed in a separate building annexed to the engine room, and was supplied by the British Thomson-Houston Co., Ltd.; it is of the remote-control cubicle type, designed for a plant capacity of 125,000 KW. The ground floor of the switch-house accommodates the cables, while the bus-bar room is on the first floor, and the on specially substantial supports, to prevent any movement on the occurrence of a very bad short circuit.

On the second floor the oil switches are arranged in two banks, divided by a wall. The switches are of the B.T.H. standard motor-operated type, and are illustrated in fig. 22, the nearest switch in the row being that which controls the 30,000-KW. set, and which is rated to carry 4,000 amperes; in this range there are 13 switches controlling the three generators, seven feeders, two rotary converters, and one interconnector. The other bank comprises at present eight feeder switches, and a 4,000-ampere bus-bar coupler is mounted between the two rows.

The feeder switches are all alike, rated at 500 amperes, and provided with split-conductor equipment, though the older feeders are not of this type. Each feeder is further protected against overload by a time-limit relay. The generator switchgear is provided with circulating-current protective gear, together with automatic circuit-breakers in the exciting circuit, and an earthing resistance and isolating

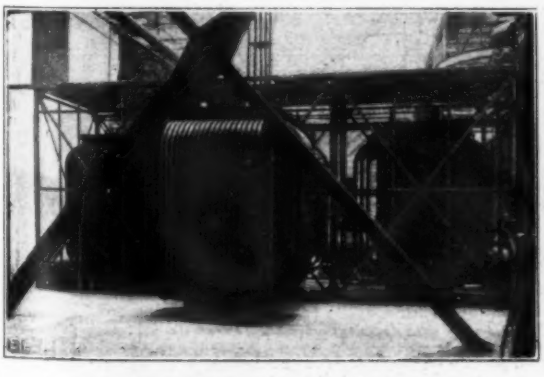


FIG. 20.—FERRANTI INTERCONNECTOR TRANSFORMERS.

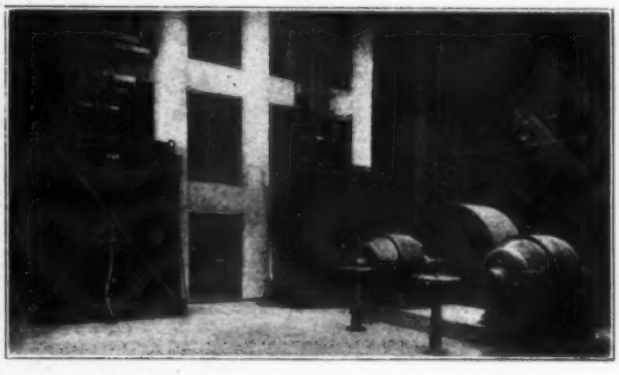


FIG. 21.—WESTINGHOUSE TRANSFORMERS FOR ROTARIES, AND SIROCCO FANS.

14,380 sq. ft., and the quantity of cooling water 19,200 gallons per minute at a temperature of 70° F.

The air pumps are of the Parsons totally enclosed reciprocating type, arranged for self-lubrication, and are driven through Parsons double-helical gearing by 40-B.H.P. motors. The small rotary pump for supplying oil to the various working parts is driven from the pinion shaft of the air-pump gearing. The whole air-pump is self-contained, and runs very quietly. The condensers are provided with the Parsons vacuum augmenter.

An auxiliary steam-driven oil pump is provided for each set for starting up, and is available in case of emergency.

The 30,000-KW. B.T.H. turbine is of the Curtis impulse type, and runs at 1,500 R.P.M. Its most economical load is 25,000 KW., at which load the guaranteed consumption is 11·1 lb. per KW.-hour. The maximum continuous load of 30,000 KW. is carried at 0·75 power factor. The stator frame of the alternator is a single hollow iron casting, with detachable panels of planished steel fitted to the outside, which give access to the interior. The winding, of formed copper bars, is carried in open slots and fixed in place with hardwood wedges; the bars are subdivided into sections which are transposed, to equalise the current distribution. The insulation in the slots consists of hard-moulded mica $\frac{1}{8}$ in. thick. The end portions are secured to stout bronze rings. The rotor is built up of steel disks on a shaft, and the windings are held in the slots by steel and bronze keys. The insulation is of mica reinforced with fibrous material, and the end portions of the windings are held in stout steel rings. Both ends of the alternator are closed by shields, and fans at both ends of the rotor draw air in from below the bed-plate and force it through the machine, whence it is discharged through a duct in the foundations. The condensing plant was supplied by Messrs. Willans and Robinson, Ltd., as sub-contractors to the B.T.H. Co., and is capable of maintaining a vacuum of 28½ in. when dealing with 277,500 lb. of steam per hour, circulating water at 70° F. being supplied at the rate of 21,900,000 lb. per hour, or about 80 lb. per lb. of steam. Two condensers are provided to cope with this enormous duty, each having a cooling surface of 22,500 sq. ft.; the exhaust passage at the turbine end measures no less than 16 ft. × 8 ft., and is connected by a breeches pipe with the condensers. Separate circulating water pipes are provided for each condenser, with stop valves, so that either of them may be laid off for cleaning while the turbine exhausts into the other one; the cleaning will be effected by means of steam ejectors with the necessary piping to enable a cleaning solution to be circulated through the tubes. A separate dry-air-pump of the Willans-Edwards totally enclosed self-lubricating type, driven directly by a 60-B.H.P. B.T.H. motor at 100 R.P.M., is provided for each condenser, and is coupled to a common pipe, so that they can be used singly or together, with either or both condensers. Vacuum-augmenter jets are also installed, discharging into the same air pipe, but each air-pump is of sufficient capacity to deal with the air from both condensers during normal leaks without the aid of the augmenters. The condensate is removed by two Pulsometer extraction pumps coupled to 23-B.H.P. B.T.H. motors, and drawing from a bus-pipe; either pump is large enough to deal with the whole of the condensate from both condensers.

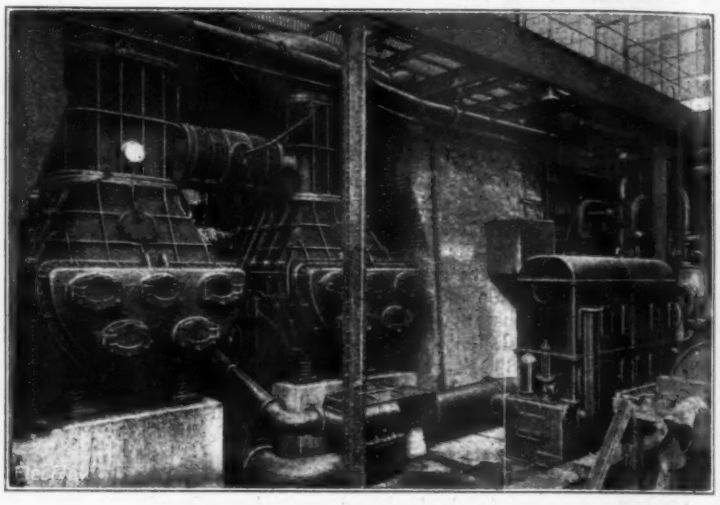


FIG. 17.—PARSONS CONDENSERS AND AIR PUMPS.

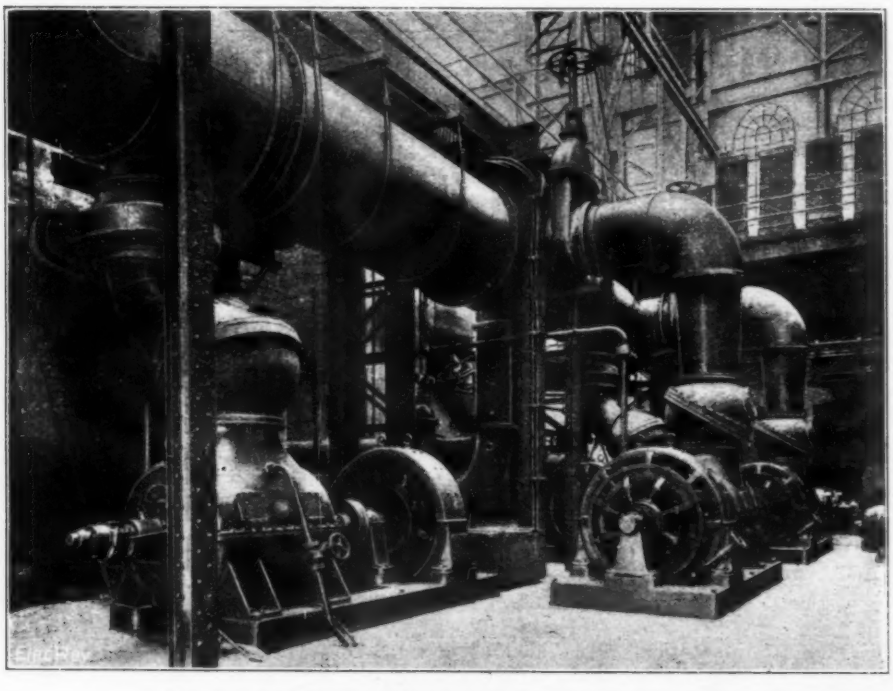


FIG. 18.—REES ROTURBO CIRCULATING PUMPS AND AITON PIPING.

Condensing water is derived entirely from the river Don, and is received through sluice gates into a sump, flowing through two Brackett revolving disk screens, 20 ft. in diameter. From the sump two culverts measuring 8 ft. 3 in. wide × 8 ft. 3 in. high carry the water under the whole length of the engine room; either culvert can be emptied for cleaning whilst the other is in use. A single culvert, measuring 10 ft. × 10 ft., on the other side of the engine room carries away the discharge from the condensers. Four circulating pumps are at present installed, two drawing from each culvert; they are of the self-regulating type made by the Rees Roturbo Co., Ltd., and are each capable of supplying 19,200 gallons of water per minute.

Each pump is driven by a B.T.H. motor of 510 B.H.P., running at 580-610 R.P.M. A rotary priming pump by the same makers, driven by a 12-B.H.P. motor, is provided. The circulating pumps all feed into a main bus-pipe, the diameter of which is tapered from 78 in. to 39 in.; from the bus-pipe the smaller condensers are fed through pipes 25 in. in diameter, and the 30,000-KW. set through 36-in. pipes, the discharge pipes being of corresponding diameters. The bus-pipe and part of the delivery pipes are constructed of mild steel plates $\frac{5}{16}$ in. thick; the flanges, branches,

FIG. 19.—CONTROL ROOM.

longitudinal and circumferential seams are all electrically welded, the bus-pipe, it is believed, being the largest ever constructed in this country on this system. The remaining pipes are of cast-iron. Expansion joints of corrugated copper are provided in all the delivery branches, and valves operated from the engine-room floor are fitted in all pump delivery and condenser inlet pipes. All the circulating water piping was supplied by Messrs. Aiton & Co., Ltd., of Derby. Part of the huge 78-in. bus-pipe, being put on rail on Armistice Day, was conspicuously painted "The Pipe of Peace." Water for the glands of the circulating pumps and for the oil coolers is taken from the bus-pipe through duplicate filters, which are cleaned at frequent intervals.

The switchgear is housed in a separate building annexed to the engine room, and was supplied by the British Thomson-Houston Co., Ltd.; it is of the remote-control cubicle type, designed for a plant capacity of 125,000 KW. The ground floor of the switch-house accommodates the cables, while the bus-bar room is on the first floor, and the oil-switch room on the second. The control room is on the fourth floor.

On the ground floor are installed the earthing resistances for the generators, together with isolating oil-switches for the latter and for the outgoing cables; here also space is available for bus-bar reactances and switchgear, which are not at present required. On the first floor, in addition to the bus-bars, which are in duplicate, are the selector switches, operated by handles outside the compartments, and the instrument transformers. The bus-bars are carried on specially substantial supports, to prevent any movement on the occurrence of a very bad short circuit.

On the second floor the oil switches are arranged in two banks, divided by a wall. The switches are of the B.T.H. standard motor-operated type, and are illustrated in fig. 22, the nearest switch in the row being that which controls the 30,000-KW. set, and which is rated to carry 4,000 amperes; in this range there are 13 switches controlling the three generators, seven feeders, two rotary converters, and one interconnector. The other bank comprises at present eight feeder switches, and a 4,000-ampere bus-bar coupler is mounted between the two rows.

The feeder switches are all alike, rated at 500 amperes, and provided with split-conductor equipment, though the older feeders are not of this type. Each feeder is further protected against overload by a time-limit relay. The generator switchgear is provided with circulating-current protective gear, together with automatic circuit-breakers in the exciting circuit, and an earthing resistance and isolating

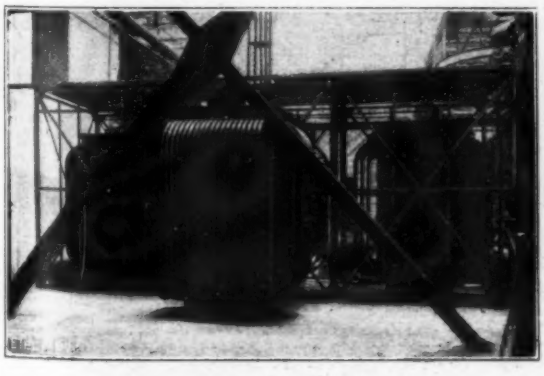


FIG. 20.—FERRANTI INTERCONNECTOR TRANSFORMERS.

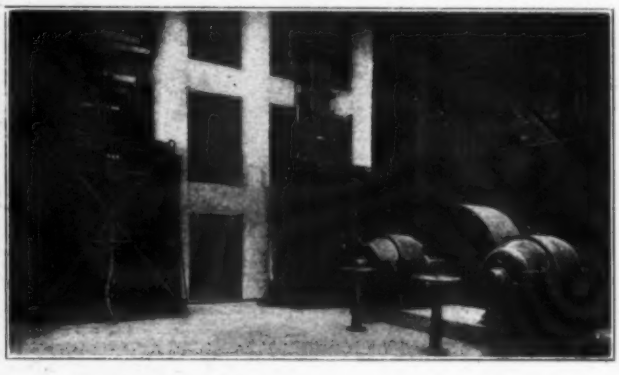


FIG. 21.—WESTINGHOUSE TRANSFORMERS FOR ROTARIES, AND SIROCCO FANS.

oil-switch. An emergency trip pedestal is installed close to the turbine stop-valve to open the generator oil-switch.

The control room is illustrated in fig. 19 ; it contains two control boards—one of 10 panels for the generators and

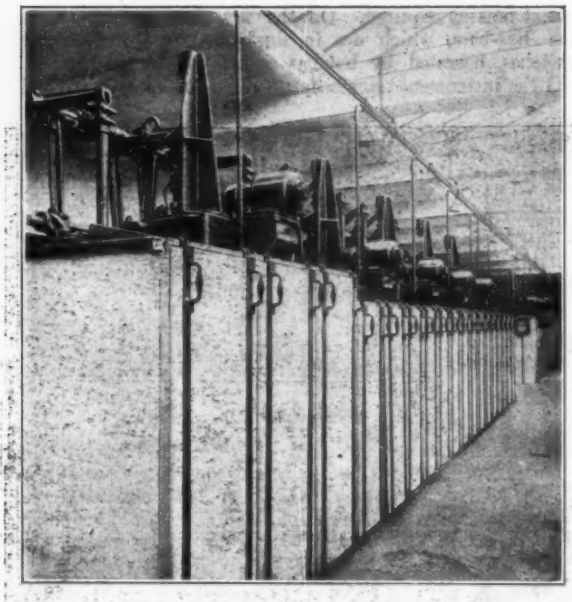


Fig. 22.—B.T.H. Oil-Switches.

rotary converters (mentioned below), an interconnector to No. 1 station, and the bus-bar coupler, as well as the Tirrill regulators (one for each alternator) and accessory switchgear ; the other of eight panels, arranged on the front of the generator board are five Chadburn electric engine-room telegraphs, with Klaxon horns, which communicate with the turbine starting platforms and the two boiler houses ; alongside of these are pillars carrying an ammeter and voltmeter for the exciter of each alternator. The room is admirably lighted from three sides and the domed roof, a semi-indirect bowl-fitting in the latter providing for night lighting.

The rheostats in the field-circuits of the alternators are electrically operated, with stand-by hand-operated rheostats.

A Chloride storage battery of 250-A.-H. capacity is installed to operate the oil-switches, pilot lamps, &c., as well as an emergency lighting circuit.

The two stations are interconnected by way of a bank of transformers, the voltage of No. 1 being 3,300 and that of No. 2 6,600 volts ; the three single-phase oil-cooled transformers, with one spare, are shown in fig. 20. They are rated at 2,085 K.V.A. each, and were made by Messrs. Ferranti, Ltd. There is also a transformer in the oil-switch room which is fed from No. 1 station, and supplies current at 230/460 volts for lighting and heating in No. 2 station, besides giving a supply to an adjoining brass foundry.

The main supply for the station auxiliaries is entirely direct-current, and is derived from two 1,500-KW. B.T.H. six-phase rotary converters, mounted in the engine-room on a level with the generators, and illustrated, with the D.C. switchboard, in fig. 23. The Westinghouse transformers for these converters are installed in the basement, near the interconnector transformers (fig. 21). The D.C. board comprises 16 black enamelled slate panels, and provides switchgear for supplying current to the traction feeders, as well as the station auxiliaries. A second set of bus-bars and four 0·2 sq. in. interconnector cables to No. 1 station enable either station to supply the D.C. circuits in both, if desired. In the basement between the two boiler-houses there is a sub-station containing two distribution boards fed from the main D.C. board, and each controlling the power supply to the auxiliaries in one boiler-house.

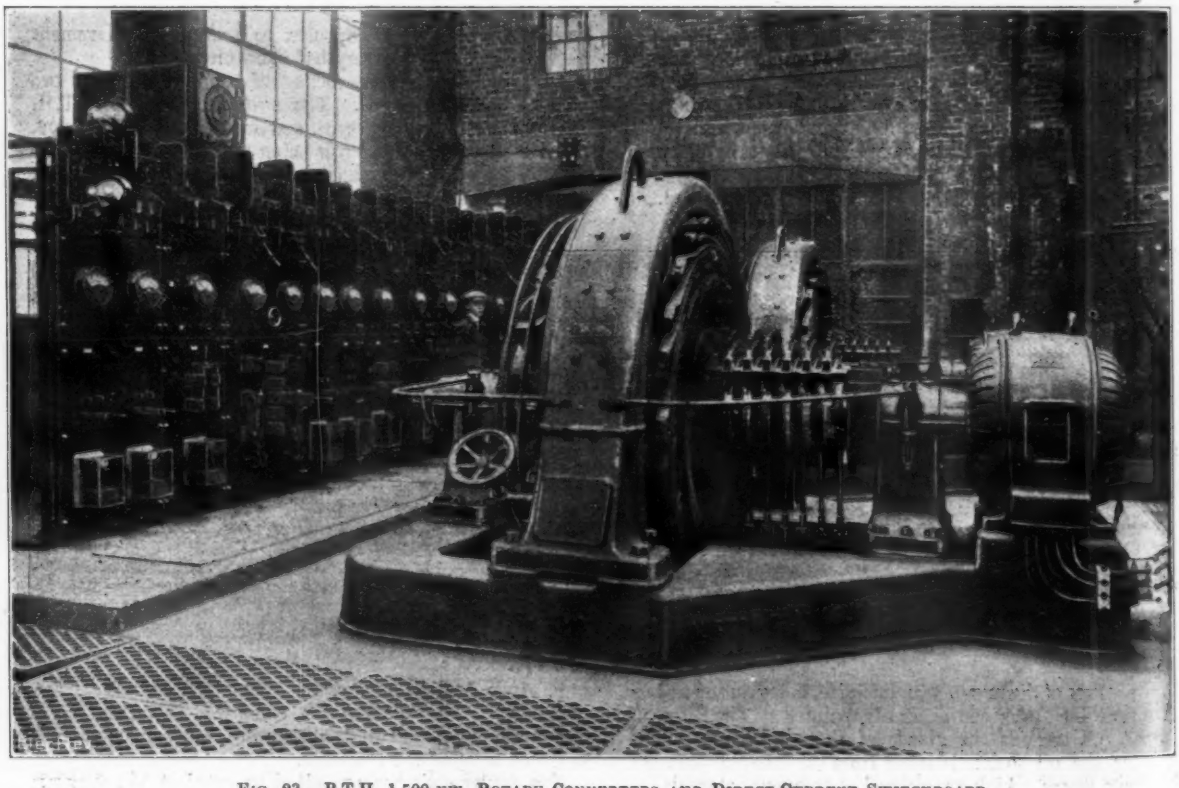


Fig. 23.—B.T.H. 1,500-KW. Rotary Converters and Direct-Current Switchboard.

circumference of a semicircle, to control 15 feeders and one spare. All the boards are of black enamelled slate. At the end of the main board is a synchronising panel, which is duplicated at the other end of the room, space being available to double the existing switchboards. In

At week-ends the generating plant in No. 2 station is usually shut down, a 5,500-KW. set in No. 1 being fed with steam from the boiler-house of No. 2 ; the condensate from No. 1 is returned by gravitation to No. 2.

A D.C. generator and booster driven by a 115 H.P. motor

is provided for charging the storage battery, and for station lighting. An air-compressor, driven by a 21-H.P. B.T.H. motor, is installed with piping to 100 points, for blowing dust out of the machines, spraying paint, &c.

A 60-ton electric crane by Messrs. Babcock & Wilcox, with a 5-ton auxiliary hoist, spans the engine-room, and a 15-ton hand crane serves the rotary converters and circulating pumps. The latter are so constructed that they can readily be opened up without dismantling much of the the piping, the whole of the bend being removed in one piece.

The cables inside the station were all supplied by Messrs. Callender's Cable and Construction Co., Ltd., special flexible single-core cables being installed to connect the alternators with the switchgear; these cables are run through porcelain tubes carried in supports of reinforced concrete. The rest of the high-pressure cables are of the three-core type, and all are paper-insulated and lead-covered. The low-pressure D.C. cables are rubber-insulated and armoured.

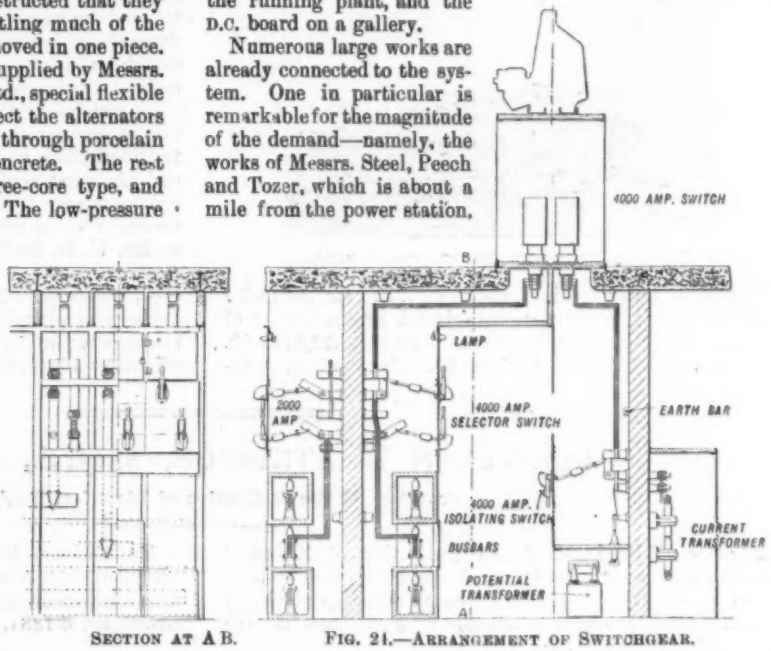
The station is extremely well lighted from the sides. Artificial light is provided by gasfilled lamps with Mazdalux reflectors, fixed above the crane, and designed to produce uniform illumination at the working level. The lighting circuits, with the exception of the emergency lights fed from the battery, are supplied with current at 230 volts by the 57·5-KW. motor-generator which charges the battery; the lighting can also be thrown entirely on the battery if necessary. The lighting installation was carried out by the British Thomson-Houston Co., Ltd.

The Rotherham area of supply is 12 miles wide, overlapping that of Sheffield at Tinsley, and coming within 300 yards of a sub-station of the Yorkshire Electric Power Supply Co., so that linking-up with these systems will be an easy matter. Very little overhead distribution is used, the mains being mostly lead-covered and single-wire armoured in iron pipes. Recently some of the mains have been laid solid in troughs. On taking over the supply from the Rawmarsh & Swinton Co., the three-wire D.C. system was converted to two-phase A.C., using the old mains. There are some 47 sub-stations on the system, many feeding small isolated networks.

From the generating station to Rawmarsh, a distance of 2½ miles, a tramway feeder is carried on the tramway poles, as a temporary measure. Supply is also given to the railless systems of the company and of the Rotherham Corporation.

In fig. 25 we illustrate the interior of a sub-station at Swinton, 6 miles from Rotherham by road. This station contains two 250-KW. rotary converters of B.T.H. and Westinghouse make, supplying the traction feeders, and a B.T.H. motor-generator fed from the traction circuit. Three-phase supply is also given, the A.C. switchboard being on the ground floor with the transformers and the running plant, and the D.C. board on a gallery.

Numerous large works are already connected to the system. One in particular is remarkable for the magnitude of the demand—namely, the works of Messrs. Steel, Peech and Tozer, which is about a mile from the power station.



SECTION AT A B. FIG. 24.—ARRANGEMENT OF SWITCHGEAR.

Eight six-core, 0·1 sq. in. cables were laid to this works, at a cost of no less than £50,000. A suspension bridge by which the cables are carried over the river Don is shown in fig. 26.

The demand of this works is 6,000 KW., and it will shortly require a further 8,000 KW. In one of the sub-stations at this works there is an induction-motor-generator of 1,250 KW., and a rotary converter of the same rating, with a handsome D.C. switchboard and A.C. switchgear. The distribution pressure is 230 volts. The works plant includes a fly-wheel motor-generator set consisting of four 3,120-KW. D.C. generators connected in series, and driven by a 3,000-H.P. induction motor, with a 230-ton flywheel running at 600 R.P.M.; a 15,000-H.P. D.C. motor, fed at 1,500 volts, and driving reversing rolls at 0-100 R.P.M.; a 5,000-H.P. induction motor driving rolls; and about 1,000 other motors.

The power-factor of the Rotherman general load is usually from 0·75 to 0 8, but sometimes rises to 0·9. The average consumption of coal at present is about 2 lb. per unit generated, and this will be reduced as the load increases.

Rotherham has long claimed to be one of the most economically operated systems in the country.

The load factor in 1918-19 was 32 3 per cent., and the plant in operation was all installed in No. 1 station (15 500 KW. —see ELEC. REV., January 24th. 1919, p. 107). During the period 1913-1918 the coal consumption decreased from 3·68 to 3·26 lb. per unit generated, but since the new station was put in commission the consumption has fallen to 2 lb., in spite of the poorer quality of the coal, and the use of the old power station at week-ends. When the plant is in full operation, therefore, we may hope to see a record established at these works. For the last complete year the average price obtained per unit sold was 1·16d., a figure which cannot be paralleled at any

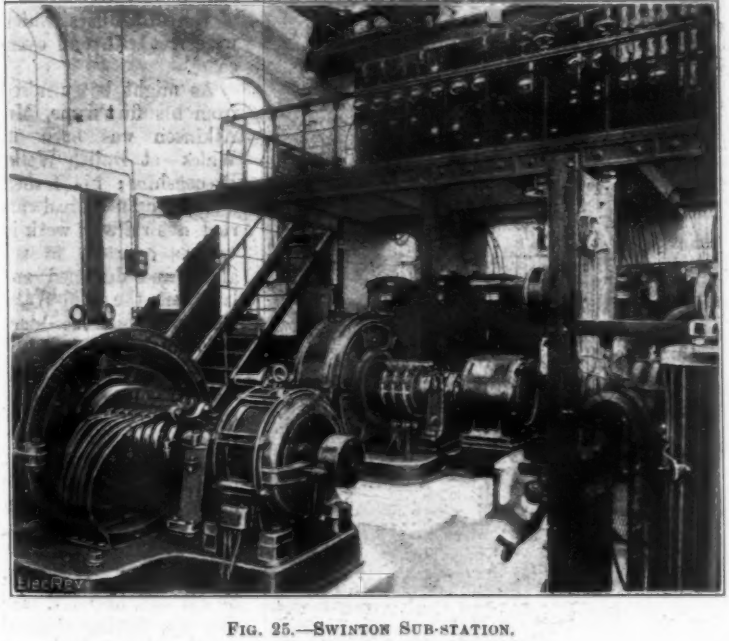


FIG. 25.—SWINTON SUB-STATION.

other undertaking in this country whose records are published. The total cost of the complete system, with plant of 70,500 KW., was about £1,200,000, or only £17 per kilowatt;

FIG. 26.—SUSPENSION BRIDGE FOR CABLES.

the cost at present prices would be *£70 per kilowatt!* The 60,000-KW. power station projected by the County of London Co. at Barking is estimated to cost £2,678,000, and the complete system £4,500,000. It is clear, therefore, that the Rotherham Corporation has acquired a first-class up-to-date power station at a pre-war price, and owing to the low capital charges, together with the high-power factor of the class of load supplied, it will be possible to offer power to manufacturers at exceptionally favourable rates. As usually happens in such cases, for the first year or two, while the new plant is only partly in commission, the annual profit hitherto recorded may give place to a deficit; but a cheap supply of power invariably creates an increased demand, and in the light of past experience we confidently predict that within two or three years the plant will be fully loaded and will produce a handsome return on the capital expended.

In concluding this brief account of a remarkable undertaking, we wish to express our thanks to Mr. Cross for the facilities which he kindly afforded us to obtain particulars and photographs of the plant, and our appreciation of the courtesy shown to us by all the members of his staff with whom we came into contact; our thanks are due especially to Mr. W. H. Duffett, chief assistant; Mr. J. R. Hawes, electrical superintendent; and Mr. W. Redmayne, mains superintendent. Mr. Cross has guided the fortunes of the Rotherham electricity department for some 19 years, and is to be congratulated on the monumental proportions and efficiency of operation of the fine plant which he controls.

LLEWELYN B. ATKINSON, M.I.E.E., A.M.Inst.C.E.,

President of the Institution of Electrical Engineers.

THE office of President of the Institution of Electrical Engineers is not only an honourable and dignified position—it is also a post involving many onerous duties, demanding almost whole-time service during a great part of the year, and calling for the exercise of the highest qualities of tact, administrative ability, urbanity, wisdom, and knowledge of men. The burden has been constantly increasing in weight of responsibility and number of different interests concerned, year by year, and since the Council definitely laid itself out to represent and watch over not only the scientific interests of the industry, but also its industrial and commercial branches, the duties of the President have become innumerable, and his journeyings incessant. Hence it is of the first importance that the post should be filled only by men who are of the highest reputation and capacity, and are held in high esteem both within and without the Institution.

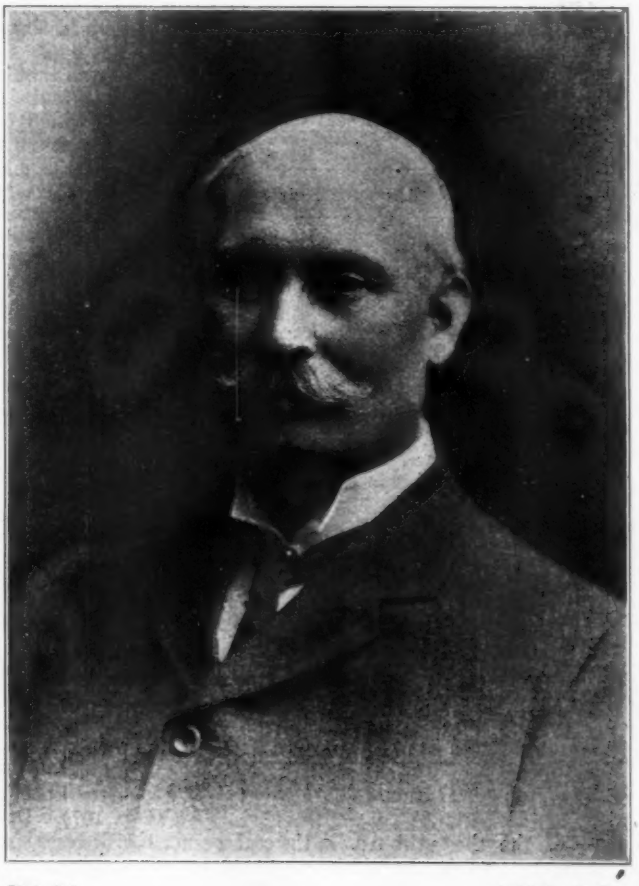


Photo. by [*Wykeham Studios.*

LLEWELYN B. ATKINSON.

For many years past those conditions have been abundantly fulfilled, and this year also the Institution is fortunate in having secured for its head one of the most able and popular men in the electrical world. We trust that he will enjoy a successful, if strenuous, year of office, and we know that, given health and strength, he will not be found wanting in any of those attributes which go to the making of a first-class President.

Mr. Atkinson is one of those men (and there are not many left) who were at work in the early eighties, in the time of pioneering between those two landmarks, the Paris Exhibition of 1881, and the classic paper by Dr. J. Hopkinson and his brother Edward, on dynamo design, which was read before the Royal Society in 1896. The path which was hewn in those days became afterwards a broad road, and those who followed can have but little conception of the difficulties which were met with and overcome.

As might be surmised from his first name, Mr. Atkinson was born in Wales—at Builth Wells, Breconshire; his father, a civil engineer, had carried out railway work in various quarters of the globe, and designed and laid out the Mid-Wales Railway, which has since been incorporated in the Cambrian system. Mr. Atkinson was educated at the Merchant Taylors' School, on the modern side, and gave special attention to physics and chemistry, with the result that, on leaving, he was awarded an Exhibition at St. Thomas's Hospital: he did not, however, take this up, having decided to adopt his father's profession. At that time electrical engineering was a coming thing, and in 1880 he attended Prof. Ayrton's evening classes in electricity at Cowper Street School, Finsbury, before the Finsbury Technical College was built, winning in 1881 the first prize and silver medal in the City and Guilds of London

Institute's examinations in electrical technology. This success brought him several invitations to become the manager of electrical companies, but he wisely decided, in accordance with the advice of Sir William Siemens, to acquire a complete engineering training, for which purpose he entered the Engineering Department of King's College, London; here his successful career was continued, he being awarded the Telford medal for gaining the highest number of marks in both his second and third years.

Having completed his technical training, Mr. Atkinson was apprenticed to Messrs. Kitson & Co.'s Airedale Works, locomotive builders, Leeds, and in 1886 he was articled to Messrs. Goolden & Trotter, of London and Halifax, being associated with Mr. Trotter and Mr. H. W. Ravenshaw in designing and experimental work in connection with dynamos. The manufactures of this firm included D.C. and A.C. machinery, and transformers, Mr. Gisbert Kapp collaborating in the A.C. work. Mr. Atkinson took out his first patent in 1886, for a dynamo brush constructed of layers with intervening resistances for the purpose of preventing sparking, a design which was revived by Mr. W. M. Mordey before the I.E.E. many years later. In the following year, Mr. Atkinson studied the application of electricity to mining, and took out many patents in connection with coal-cutting and other machinery.

One of his first jobs in 1887, at Halifax, was to design, with Mr. W. H. Ravenshaw a 6-H.P. direct-current motor, and to build it on to a coal-cutting machine of the bar type. This was the first electric coal-cutter, and the capabilities of the electric drive were demonstrated as soon as it was put to work, by breaking the cutter bar. This led to his spending a good deal of time practically working at the coal face, and designing an improved cutter bar. Four years later, in collaboration with his brother Claude, their paper on "Electric Mining Machinery" was awarded the Telford gold medal and premium by the Institution of Civil Engineers.

One of his early experiments about 1888 was trying to run a small motor having laminated fields, with alternating current, and he found that, though it was not of much use as an ordinary series motor, it ran fairly well with a decided torque when alternating current was applied to the field windings, the armature short-circuited, and the brushes rocked about 45°. The arrangement is quite well understood to-day, but it was surprising when first tried as an experiment at a time when synchronous motors were undeveloped, and some five years before the great controversy took place on alternating-current motors.

In 1888, Mr. Trotter having retired, he became a partner in the firm of Messrs. Goolden & Co. Next year the works were removed to London, and considerably extended under Mr. Eversheld, the instrument-making department was developed into an important section of the business. In 1893 the business of the company was amalgamated with that of Messrs. Easton & Anderson, under the title of Easton, Anderson & Goolden, Ltd., and Mr. Atkinson became a director of the new company, until he retired in 1897. In the following year he read a paper before the Institution of Civil Engineers on the "Theory, Design, and Working of Alternate-Current Motors," which was awarded a Telford premium. That paper was long before its time; it contained the fundamental principles of almost every kind of A.C. motor, anticipating many later inventions, and had it not been buried in the archives of the Civil Engineers, owing to the secretive practice of that Institution, it might have exerted a considerable influence on the position of this country in this industry.

Although Mr. Atkinson had attained to so high a position on the technical side of the industry, he always had a strong bent towards the commercial side, and his next undertaking bore in that direction, marking a new epoch in his career. In conjunction with the late Mr. P. J. Fawcus, and others, he founded the Trafford Park Power and Light Supply Co., Ltd., the first company formed in this country with the primary object of distributing cheap power over an industrial area; for nearly 20 years he was a director of this company, which was recently absorbed by the Stretford Urban District Council. One of the firms which built works in Trafford Park was that of Messrs. W. T. Glover and Co., Ltd., and when this firm was reorganised in 1903, Mr. Atkinson was invited to become a director, a post which he occupied for about 17 years, being for the greater part of that time in charge of the London office of the company. The business was recently purchased by Messrs. Vickers, Ltd., and he was invited to remain on the board, but retired on account of his many other occupations.

We now come to a third period in Mr. Atkinson's career—his connection with the Cable-Makers' Association. He had taken a prominent part in the affairs of this Association from the time when he joined the board of Glover's, being at one time chairman; his exceptional qualities were therefore familiar to his associates, and on the death of the late Mr. A. H. Howard, in 1916, he was unanimously invited by his colleagues in the cable-making industry to become the secretary and manager of the Association, a position which he still occupies. He is also chairman of the Joint Industrial Council of the cable-making industry.

It must not be supposed, however, that Mr. Atkinson's preoccupations in other fields diminished his interest in electrical engineering proper; he frequently took part in the discussions of the Institution of Electrical Engineers, of which he became a member in 1900, and in 1918 he delivered a remarkable address (the 10th Kelvin lecture) to the Institution, on "The Dynamical Theory of Electric Engines," in which he opened up a new field of thought and investigation which had been previously almost wholly neglected. In 1917 he was elected a Member of Council, and in 1919 Vice-President of the Institution. Amongst other of his multifarious activities, we may mention that he is a member of the Electrical Sectional Committee of the British Engineering Standards Association; a representative of the I.E.E. on the Electrical Research Committee; a representative of the C.M.A. on the Electrical Development Association; and a Member of Council of the Federation of British Industries. For many years he has been a member of the Dynamicables, of the 25 Club, and of the Electro-Harmonic Society, and other bodies connected with the social side of the industry.

Mr. Atkinson has several times visited America, and in 1893, the year of the Chicago Exposition, he was invited by the Westinghouse Co. to remain in the United States and organise an electrical mining department of their business, but his engagements at home prevented his acceptance of the offer. He has also visited German and Belgian industrial centres in connection with technical and commercial affairs. His inventions and patents cover a wide range, including mining machinery, D.C. and A.C. apparatus, electrical instruments and demand indicators, &c., and he has carried on research and testing laboratories of his own. He was also at one time a frequent contributor to the electrical and financial Press on electrotechnical and commercial matters.

Mr. Atkinson is a man of very remarkable character, combining the methodical, deliberate, and precise habits of mind derived from a scientific training with extraordinary versatility and "savoir faire." His inclinations are progressive, and he scorns obsolete methods or apparatus.

He is very even-tempered and forbearing, and exceedingly sensitive to discord between himself and others or amongst others with whom he associates. He is a humanitarian with broad views of life, and a great lover of his home, which, as would be expected, is of a unique character, replete with domestic labour-saving devices. In addition to his many and varied professional activities, he is an agriculturist, and runs a small farm on scientific lines.

His hobbies are collecting slide rules and spinning tops, the latter especially giving him great enjoyment. As for sports and pastimes, he plays golf so badly and so good-humouredly that he seems to do so rather to give amusement to the onlookers than for the sake of personal pleasure.

His scientific habit of thought prevents him from doing anything by chance, and yet, as though his nature demanded an outlet by way of relaxation from such severe, precise, and rigid calculations, he has been known to pounce upon a friend who has happened to win a small stake at cards, and, with great delight, to toss him for the proceeds—which he invariably wins.

It may not be generally known that during the war he served as a special constable.

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Recent history is silent as to whether he is still a fisherman, but rumour says that it was he who, as a lad, called at the local squire's house to ask for permission to fish in his lake, and when this was curtly, and, as he considered, rudely, refused and the door slammed in his face, noticing that the key was on the outside of the door, he turned it in the lock and threw it in the lake on his way home.

In the proceedings of the Institution, Mr. Atkinson's most noteworthy attributes are his extraordinary lucidity in debate, and his mercilessly logical method of developing his argument, combined with remarkable powers of penetration to the roots of the matter and of expressing his views in concise, clear-cut English. His power of seeing both sides of a question does not prevent him from forming very definite views, to which he gives expression in uncompromising terms, without fear or favour. On the other hand, his tact and suavity, combined with his personal popularity, are priceless qualities in the conduct of discussions, and he has many times carried through difficult negotiations to a successful issue where others would have arrived at a deadlock.

Those who have heard his many speeches at Institution functions during the past year—sparkling with humour, but always with an undercurrent of sound and serious import—know that the industry will be well and worthily represented on all such occasions during the ensuing year; and the President's admirable record of success in engineering and in business guarantees that the affairs of the Institution, technical, commercial, and social, will be guided on the soundest lines whilst he holds the reins of office.

THE "TURBINE" BOILER FURNACE.

In these days of expensive fuels any device that is calculated to promote fuel economy and increased steaming efficiency is worthy of consideration. If the air flow is uniform and the fuel is spread evenly over the grate, combustion will also be uniform and even throughout the whole area of the fire. In an ordinary boiler furnace these conditions are not necessarily fulfilled, resulting in an excessive air flow through the grate, which is a particularly active source of loss. By the use of the furnace hereunder described, however, it is claimed that a considerable reduction in the amount of excess air can be made, the air can be thoroughly diffused over the whole area of the grate, and it can be brought everywhere into intimate contact with the fuel.

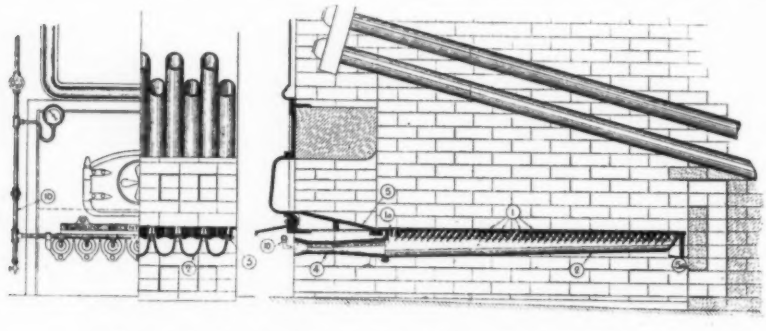
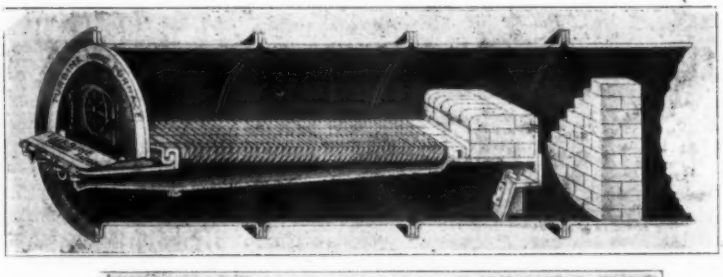


Fig. 1.—"Turbine" Furnace Applied to B. & W. Boiler.



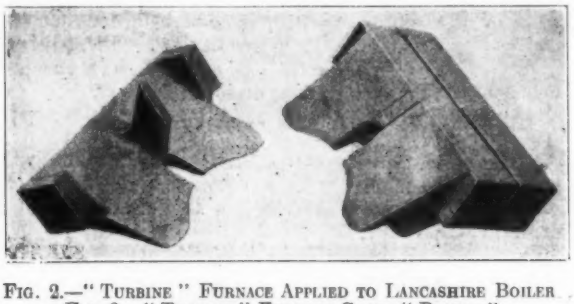


Fig. 2.—"Turbine" Furnace Applied to Lancashire Boiler.
Fig. 3.—"Turbine" Furnace Grate "Blades."

The furnace under consideration takes its name from the analogy which its form in longitudinal section bears to the jet and blades of an impulse de Laval steam turbine, the intention being that the air shall pass up between the fire bars at an equal rate over the whole surface of the grate.

The constructional details will be gathered from fig. 1, which shows the furnace as applied to a Babcock & Wilcox boiler; fig. 2 shows its application to a Lancashire boiler; and fig. 3 illustrates the "Turbine" furnace "blades."

As shown in fig. 1 several troughs (the number varies with the width of the furnace) rounded at the bottom and measuring about 5 in. across their mouths are disposed longitudinally within the furnace flue. Each trough is separate from the rest, and lies, unbolted, in contact with its neighbours, being hooked at either end over ridges on the dead and bridge plates (5) and (5a), but otherwise unsupported. Angle-sectioned extension pieces (3) are bolted to the two outer troughs so as to fill the gaps between them and the furnace walls.

Within the mouths of the troughs are placed fire-bar members (1), the form of which will be readily followed from fig. 3. Each "blade" shown in fig. 1 in sectional elevation is part of a separate casting (fig. 3), so that each trough has, say, three or four dozen of these separate fire-bar castings, which are supported on the edges of the troughs. Each casting is provided with a slot in front and with a flat web behind (fig. 3), which fits into the slot of the succeeding casting. It will be appreciated then that the fire-bar castings can be rapidly slid into position, the whole being locked together by the insertion of the last member (1a), fig. 1.

The top surface of the grate thus formed is, however, not continuous; between each pair of castings a ¼-in. wide slot is left for the passage of air from the trough below, fig. 2, the width of the slot being preserved even when the castings are tightly pressed together. The rear face of the blade of each casting lies at an angle of 45 deg. to the general top surface of the grate; the forward face of the succeeding casting makes an angle of 60 deg. with the same plane; and the ¼-in. slot between the pair is thus continued below in the form of an inclined tapered passage. It is this form of air passage, it is claimed, which enables the finest fuels (even in a powdered form) to be burned, because the inclined surfaces tend to prevent the fuel falling through the slots between the fire-bar members. As shown at (2), fig. 1, the bottom edges of the sloping blades are formed to a radius so that with the curved bottom of the trough they make an approximately circular passage for the air flowing along the trough. The area of this passage, owing to the inclined trough bottom, the trough being shallower towards the back than at the front, decreases from back to front in such a way that, as air escapes through the successive slots into the fire, the velocity of the remainder in the trough remains constant.

Air is drawn into the troughs by means of a separate steam jet (10) for each trough, which is placed at the mouth of an

injector pipe (4). For the first portion of their length the injector pipes contract in diameter; for the centre portion they are parallel; and for the remaining portion they expand to suit the radius of the trough bottom as shown at (4).

All the steam jets are connected to a single source of steam; the nozzles have a large coefficient of expansion, and their form is such that the jet of steam splays out and fills the bore of the injector pipe. Superheated steam is used for the jets. The supply is taken from the top of the boiler and led by a system of piping through a reducing valve and pressure gauge for some distance into the side flue before passing to the jets. This form of superheater is very simple and easy to install, it being necessary to remove a single brick only from the boiler setting. The employment of superheated steam, it is claimed, increases the efficiency of the injector jets, because for equal weights the volume delivered is greater if superheated. Further, the use of a number of small jets also leads to economy, for the amount of steam used is proportional to the square of the jet diameter. The air pressure prevailing in the troughs depends on the pressure of the steam delivered to the jets. Therefore, the air pressure below the fire bars can be regulated over a considerable range, so that a wide variety of fuel can be burned in a furnace at different times. The ash and clinker are removed by raking them out over the dead plate (5), fig. 1. Very little dust falls through the bars into the troughs; what does is removed by a long-handled scoop. A large proportion collects in the combustion chamber between the two brick bridges shown in fig. 2, and is removed through the door shown.

"Turbine" furnaces can be readily fitted to any type of existing boiler. As regards their performance, we recently had an opportunity of inspecting several installations at work which, according to their uses, are giving every satisfaction. The claims made for them with regard to performance and ability to burn cheap low-grade fuels appear at first sight to be very high, but a number of tests have been carried out on installations in various parts of the country, and in every case the furnaces have performed their proper functions in a commendable manner.

REVIEWS.

The Principles of Electrical Engineering and their Application. By Gisbert Kapp, M.I.C.E. Vol. II. Application. Pp. xv+384; 173 figs. London: E. Arnold. Price 18s. net.

In this book it is pleasing to note the continuance and enlargement of the lucid chapters contained in Dr. Kapp's previous volume. We have yet to see a more comprehensive statement of electrical principles, and in like manner the fundamental applications are set out. It is true that certain details one might have looked for are not dealt with, but in the main the ground is well covered. Again in this volume one is led in a careful manner through the maze, so that even the most intricate problem is brought to a conclusion without having to traverse devious paths. With his almost uncanny facility for reducing an otherwise complicated formula to a simple expression, the author enables one to memorise facts and figures so that they become anything but difficult, and withal he carefully explains his reasoning and indicates the very truth of each constant and variable.

The main headings of the first volume may be reiterated with advantage, viz., Conductors, Resistance, Distribution, Electrostatics, Electromagnetism, Electrodynamics, Units, Magnetic qualities of Iron, and Alternating Currents; having obtained a complete knowledge of these items, one is led to questions of dynamo design, and the second volume opens with a discussion relative to the armature, and here we are at once impressed with the clarity of presentation. Field magnets are next treated of, and the paragraphs dealing with the critical speed of turbo-dynamos are of absorbing interest. In the chapter relative to the complete dynamo there is much to attract one, but the vexed question of commutation is dealt with in a more than ordinary manner; here and in the following pages on working conditions, Dr. Kapp is probably at his best, the manner in which details and special applications are introduced being especially bright. The importance of obtaining a good load factor upon plant makes the next chapter one that will appeal to all, and "The dynamo in connection with a storage battery" forms a fitting title thereto; though brief, the matter is comprehensive. Few are qualified to pen a chapter on experimental work with the assurance of Dr. Kapp, and, as we have noted previously, his modesty in dealing with points upon which he is an expert, is most marked. Many engineers might with advantage model their tests upon the examples and methods indicated.

We now turn to alternators, and bearing in mind the principles so clearly enunciated in the first volume, we are able to appreciate to the full the problems now reached. The subject matter relative to harmonics is very detailed, but fully explicit. The next two chapters relate especially to the practical working of alternators, and there is much of interest to be gleaned from them. Converters form the subject next handled, these are very briefly tackled. Following upon this a digest of the author's classic work on "Transformers" forms the basis of two chapters, and again we are compelled to admire. Of late years the induction motor and alternating current commutator motors have attracted much serious attention as subjects for especial and careful study and research, and for anyone who desires to learn in a concise yet complete manner the considerations attached thereto, we cannot but recommend the perusal of the pages before us; the principles involved may be then mastered in a facile manner. Readers of the recent lines in this periodical anent power factor will find Dr. Kapp's last chapter relating to phase advancing, enlightening and worthy of consideration.

The work concludes, in a manner similar to its predecessor, with a good general index and index to formulæ; in spite of difficulties, the general quality of the book shows no deterioration. The two volumes form an admirable handbook for the student and the general engineer, and with advantage may be read by all whose business brings them in contact with electrical machines and installations.

The Year Book of Wireless Telegraphy and Telephony, 1920. Pp. 1,148, illustrated. London: Wireless Press, Ltd. Price 10s. 6d. net.

For the eighth year in succession this publication makes its appearance. During the eventful years which have elapsed since it was first offered to supply a very real need, the scope and excellence of the volume have been steadily increased, and the Year Book has long since come to be regarded as indispensable to anyone associated with wireless work. The latest edition embodies quite a number of distinct improvements, apart from the special technical articles which always constitute so valuable a feature of the book. Dealing first with these improvements in the arrangement of standard matter and chronological records, &c., we find that the calendar has been improved by the addition of the times of sunrise and sunset (Greenwich meridian), and by the inclusion of the phases of the moon. All matter relating to wireless progress has been transferred from the calendar to the special "record of development," which has been thoroughly revised by Dr. N. W. McLachlan; we do not notice in this record any particulars of the long-distance Poulsen arc stations erected in France and Italy and certain other countries during recent years. The section on laws and regulations appertaining to wireless has been enriched by the addition of much fresh information, and the general arrangement of this important section is now exceptionally clear and concise. A point which will appeal to every user of the volume is the inclusion of small maps of each country in the pages dealing with its wireless laws and regulations. These detail maps replace the unwieldy world-chart which has formed a feature of previous editions. For purposes of reference to individual countries and stations the detail maps are undoubtedly more convenient and useful than the world chart, but the latter (on a smaller scale than hitherto) should certainly be restored in future editions. The individual stations need be identified only by reference numbers, if at all, but it is often very convenient to have a map showing the general location of all the world's wireless routes at a glance.

The list of land and ship stations and their call letters has again been revised and brought up to date, and the same applies to all the other reference sections, including the directories of wireless companies and wireless societies; the biographical notes; the literature of wireless telegraphy; the Morse code section, and so forth. The bibliography of literature on wireless telegraphy and telephony is a very valuable feature, erring only on the side that it contains a number of books bearing rather indirectly on wireless matters.

Turning to the special articles which always form such a feature of interest in this volume, we find a welcome co-ordination of all the meteorological data in one section. Writing on radio-communication and meteorology, Lieut.-Col. E. Gold gives (in addition to valuable purely technical data) a most instructive demonstration of the mishaps attending imperfect weather forecasts, and a most convincing statement of the achievements now realised in this branch of meteorology. Few people realise the extent to which weather forecasts were employed during the war. Mr. A. R. Hinks writes upon wireless and time, and indicates that, as in connection with weather forecasts, wireless has made possible results which could otherwise not be achieved.

One of the most valuable features of the new edition is the excellent series of "National Resumes." Each résumé is written by a well-known wireless engineer, and covers the past year's progress and general status of wireless telegraphy and telephony in the country concerned. Résumés are given for France, Germany, Great Britain, Holland, Italy, Japan, Norway, and the United States. It is certainly to be hoped that this innovation will be made a regular feature of the year book and that résumés for other countries will be added as occasion arises. At present these national résumés occupy a total of less than 30 pages, and we should like to see them enlarged somewhat in the next edition.

Mr. W. T. Ditcham gives a very good review of the progress of wireless telephony, and suggests that the latter will be one of the commonplaces of everyday commercial life in the near future. Mr. F. P. Swann, writing upon valve amplifiers for shipboard use, explains the considerations which led to the adoption of the present design of this amplifier. The equip-

ment described is calculated to give a minimum of trouble in operation and maintenance, and it is likely to remain effective for a reasonable period whatever the general technical developments introduced into wireless practice in the meantime. The relative merits of various circuits and points relating to practical operation are discussed in detail.

Aviation has made such rapid progress during recent years, and "wireless" plays such an important part in modern aviation that it is not surprising to find a special section of the year book devoted to aero-wireless work. Major Robert Orme writes upon radiotelegraphy and aviation, pointing out the difficult conditions to be met in aeroplane service, and reviewing the enormous progress made during the war. It is not too much to say that wireless in relation to aviation is entirely a war development so far as really practical results are concerned. Major Orme very properly lays stress upon the enormous importance of directional wireless in the navigation of aircraft, and states that the navigational applications are probably the most valuable contribution which the wireless engineer can afford to the science of aeronautics. Many airmen and sailors, as well as wireless operators and students, will read with interest Mr. G. M. Wright's contribution on direction finding, in which he considers the fundamental "geometry" of the problem, and also the requirements and technique from the wireless point of view.

Major C. E. Prince's very excellent paper on wireless telephony and its application to aircraft surveys the almost incredible progress made during five years of strenuous effort. The story of difficulty after difficulty overcome makes fascinating reading, and we have reason to be grateful to the men whose efforts established telephony as a working organisation in the British flying service, and evoked official admission in a German Army Order that we were far ahead in C.W. and telephone work. There is no technical reason at the present day why an ordinary telephone subscriber should not be able to speak to an aeroplane in flight anywhere within 100 miles or so.

Consideration of space limitations necessitates conclusion of what is even now but a very sketchy outline of the matter contained in this year book. The compilations of valve and wireless telegraph patents in 1919, and the section on wireless terminology and useful data are a continuation of features which have already proved their value. Two short chapters of special interest pay well-earned tribute to the work of the Berne Bureau or international clearing house for radiotelegraphy, and to the services rendered to wireless by the "amateur" experimenter. A new directory feature is a list of aerodromes fitted with wireless, and a list of aviation identification and call letters. Unquestionably the Year Book is this year better than ever before.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. Skinner (Foster, Skinner and Co.), electric fittings dealer, Liverpool.—First meeting was held on November 4th, at Official Receiver's offices, Liverpool. Public examination, November 29th, at the Court House, Liverpool.

Harrison & Sons, electrical engineers, 93, Princes Street, London Road, Southend-on-Sea.—First meeting, November 9th, at 14, Bedford Road, W.C. Public examination, December 1st, at the Shire Hall, Chelmsford.

W. T. Smith, electrical and mechanical engineer, Victoria Street, Bolton—1s. 8d. first instalment of composition of 5s. in the £, payable November 8th, at the Official Receiver's Office, Byrom Street, Manchester.

G. W. Lester (Lester & Browne), electrical engineer, 44 and 46, Surbiton Road, Kingston-on-Thames.—Receiving order made October 30th on creditors' petition. First meeting November 15th; public examination, January 14th, 1921, both at Carey Street, W.C.

W. H. S. Ward, electrical engineer, 56, High Street, Acton.—Receiving order made October 29th on creditors' petition.

J. C. Thomson, electrician (lately electrical engineer and contractor), late of Station Street, Mansfield, Notts.—Receiving order made October 30th, on debtor's own petition.

E. Cloney, tramway divisional traffic superintendent 5, St. Albans Road, Parliament Hill Fields, N.W. 5.—Last day for proofs for dividend, November 17th. Trustee, Mr. W. P. Bowyer, Senior Official Receiver, Carey Street, W.C.

Company Liquidations.—Electrolytic Co., Spain and Portugal, Ltd.—Meeting of creditors is called for November 11th, at 5, Moorgate Street Buildings, E.C. Particulars of claims to be sent to the liquidator, Mr. R. J. Marsden, by December 16th.

Commercial Electrical Accessories, Ltd.—Particulars of claims must be sent to the liquidator, Mr. N. Bell, 79, Wool Exchange, E.C., by November 26th.

Accumulators, Ltd.—Meeting of members is called for November 29th, at Carlton House, 11D, Regent Street, S.W., to hear an account of the winding up from the liquidator, Mr. W. J. Matthews.

Telephos Domestic and Street Lighting Co., Ltd.—Meeting of members is called for November 13th, at 805, Salisbury House, E.C., to hear an account of the winding up from the liquidator, Mr. H. H. Foster.

Masham and District Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. T. E. Thwaites.

Dissolution of Partnership. — Engineering Supplies Co., consulting mechanical and electrical engineers, 24, Grey Street, Newcastle-on-Tyne.—Mr. J. W. Finney and Mr. H. W. Slater have dissolved partnership. Debts will be attended to by Mr. H. W. Slater, who will continue the business under the same style and at the same address.

Trade Announcements. — Southern Electric Co., Ltd., has removed to permanent premises at 138, Southwark Street, S.E. 1, and will shortly open a trade counter and showroom. Telephone, Hop 2780.

The Yule Electric Co., 47, Station Road, Winchmore Hill, N. 21, is closing down. All debts will be attended to by the company. Remittances should be sent to the Yule Electric Co., at 9, Delhi Road, Edmonton, London, N. 9.

Messrs. Jones & Pordes have appointed the following sole agents for the sale of their "Elba" dry cells:—Midlands, Phillips and Turner, 115, Edmund Street, Birmingham; S. Yorkshire, Derby, and Nottingham, the Hallamshire Electric Co., Ltd., 16, Carver Street, Sheffield; Principality of Wales, the Commercial Electrical Supplies Co., 8, Westgate Street, Cardiff; W. and S.W. of England, the Elco Manufacturing Co., Colston Yard, Colston Street, Bristol; and Central Yorkshire, Rickard, Wright & Dean, Ltd., 17, Neal Street, Bradford.

English Electric & Siemens Supplies, Ltd.—An amalgamation has been completed between English Electric Supplies, Ltd., and the lamp and supplies department of Messrs. Siemens Bros. and Co., Ltd., and from November 1st the business will be carried on under the title of English Electric & Siemens Supplies, Ltd.; registered office, Brook House, 191 and 192, Tottenham Court Road, W.; the supplies department, showrooms, and stores will be retained, and all orders and business in connection therewith dealt with from that address.

Messrs. Belling & Co., Derby Road Works, Edmonton, N. 18 have purchased the designs and registrations and certain materials of the Yule Electric Co., and are arranging to continue supplying some of the articles which the company has been making for which a demand continues.

London Electric Stores will remove on November 8th to 39, Furnival Street, Holborn, E.C. 4. Telephone No., Museum 4902.

Citroen Gear Co. has removed to 22, Buckingham Gate, Westminster, S.W. 1. Telephone No., Victoria 7193; Telegraphic address, Helical, Sowest, London.

Catalogues and Lists.—Messrs. Pirelli, Ltd., 144, Queen Victoria Street, E.C. 4.—Price list (48 pp.) of wires and cables, including pure and V.I.R., asbestos, and silk-covered types. Also accessories for installation work, rubber gloves, ebonite tubes, rods, and sheets, &c. Illustrated.

Messrs. Jones & Pordes, 8, Crawford Passage, Farringdon Road, E.C. 1.—A circular letter announcing that "Elba" accumulators have now been placed on the market in five sizes from 20 to 100 amperes, 2-6 volts. A year's guarantee is given.

The Newman Electrical Co., 64, Newman Street, W. 1.—Leaflet illustrating and describing "Nuco" artistic fittings for semi-indirect lighting with alabaster and opal bowls. Fully priced.

The Enterprise Manufacturing Co., Ltd., Gun Street Electrical Works, Bishopsgate, E. 1.—An illustrated and fully priced catalogue (24 pp.) dealing with electric fans, small motors, starters, switch and fuse gear, &c.

British Insulated and Helsby Cables, Ltd., Prescot, Lancs.—A very complete catalogue (104 pp.) of accessories for telegraph and telephone line construction, including insulators, bolts, poles, fittings, tools, and batteries. Well illustrated and dimensioned.

The J. G. Brill Co., 150, Southampton Row, W.C. 1.—A booklet (4 pp.) entitled "A New Point of View," giving two or three testimonials in favour of the "Birney" safety car.

Messrs. T. M. Johns & Co., 3, Buckland Terrace, Plymouth.—A priced leaflet illustrating the "Jona" bell transformer, and a list of seven cables for sale.

Messrs. Yarnall & Co., Cornwall Street Ironworks, Openshaw, Manchester. Stock list of new and second-hand D.C. motors.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Leaflet No. O. 2,368, giving particulars and prices of "Gecko" accumulators for ignition, starting and lighting. Also an illustrated folder dealing with "Osram" vacuum and gasfilled lamps. Priced.

Messrs. Greenwood & Batley, Ltd., Donington House, Norfolk Street, Strand, W.C. 2.—An illustrated and priced catalogue (15 pp.) of "Bipol" electric storage batteries, lighting sets for cycles, and charging boards. Also two leaflets, one giving prices of batteries and lighting sets, and the other illustrating the "Teo" patent electric police service lamp.

The Overseas Engineering Co., Ltd., 163-165, Great Portland Street, W. 1.—List No. 175, a priced and illustrated specification of "Overseas-National" steam-driven dynamos. Also List No. 135 P, a pamphlet in Portuguese, illustrating and describing "Overest" electric light installations.

Book Notices.—"The *Financial Times* Income-Tax Guide, 1920 Edition (revised)" (36 pp.). London: The Financial Times, Ltd.; price 1s. net.—In view of the radical revision made in the Income-Tax by the Finance Act, 1920, this little guide will prove invaluable to all affected. The booklet is divided into eight sections dealing respectively with earned incomes (detailing abatements and allowances, life assurance, &c.); unearned income (Government bonds, Treasury Bills, &c.); how assessment is made; relief and how to obtain it; the super-tax; the excess profits tax; Corporation profits tax and death duties. Every point is clearly explained, and tables are included to illustrate the text.

"A Proposal to Increase the Purchasing Power of the Penny" (7 pp.). By Harry Allcock, M.I.E.E.—In this short paper Mr. Allcock puts forward the suggestions made by him at the Cardiff meeting of the British Association (*vide* ELECTRICAL REVIEW, September 10th, 1920, p. 347).

"Electric Lighting for Cycles and Motor Cycles." By H. H. W. Cross. Pp. xiii + 124, figs. 50. London: E. and F. N. Spon, Ltd. Price 3s. 6d. net.

Scientific Papers of the U.S. Bureau of Standards, No. 391, "Measurement of Diffuse Reflection Factors, and a new Absolute Reflectometer" (15 pp.), and No. 392, "A Photographic Method of Detecting Changes in a Complicated Group of Objects" (12 pp.). Washington: Government Printing Office. Price 5 cents each.

"The English Electric Journal," Vol. I, No. 4. October, 1920. (54 pp.) London: The English Electric Co., Ltd.—The Siemens Works, Stafford is described in this issue, and the illustrations are particularly good. Mr. R. A. R. Bolton contributes an article on "The Switchgear Problem in the Power House," and a long paper on "Test Corrections for Impulse Steam Turbines," by Mr. R. Livingstone, A.M.I.E.E., also appears, as well as notes "On a Theory of Fluid Friction and its Application to Hydraulics," by Mr. E. Parry, B.Sc., &c.

"Labour: Its Output and Reward" (18 pp.). By Percy J. Pybus, C.B.E., M.I.E.E.—A lecture given in the Department of Industrial Administration, College of Technology, Manchester. Manchester: University Press.

"Tait's Electrical Directory of Australia and New Zealand, 1920." Fourth edition (186 pp.). Melbourne: Peter G. Tait.—This edition, which supersedes that of 1918, gives very complete particulars of about 700 undertakings in the Antipodes. In many cases the financial results of last year's working are included. An index of stations by States is included for easy reference.

"The Industrial League and Council *Journal*." Vol. II, No. 9 (36 pp.). Price 6d.—The October issue of this journal contains a number of instructive and interesting articles on industrial questions. Among these is "Work for the Industrial League," by Mr. T. O. Jacobsen, J.P., L.C.C., and "The Industrial Situation," by Mr. H. G. Williams, M.Sc. Mr. G. N. Barnes's paper, read at Olympia recently, is reprinted, and an account of speeches made at the Eccentric Club dinner of the Executive Committee of the Council, is given.

Trade and Industry in Australia.—An interesting address was given by Mr. S. W. B. McGregor to the British Empire Producers' Organisation, on October 28th, on British Trade and Industry in Australia. Mr. Ben. H. Morgan, chairman of the Organisation, presided. Mr. McGregor dealt with the great industrial development of the Commonwealth in the last few years. The three main channels were wool manufacturing, the steel industry, and the boot and leather trades, for all of which Australia had raw materials in plenty. He mentioned the Australian Government scheme to use one-third of the annual clip for manufacturing woollen goods in the Commonwealth. An expenditure of about £14,000,000 was contemplated. Last year the principal steel works turned out 162,000 tons of pig iron and 185,000 steel ingots. Australia manufactured during last year about 15 million pairs of boots and shoes. With regard to the Australian law which prevents an industrialist making contracts on this side with workmen to go Australia, Mr. McGregor said that, though he could make no pronouncement, he understood that this Act was not enforced to operate against the introduction of skilled labour into the country for Australia's new industries.

Rumanian Reconstruction.—The Department of Overseas Trade learns from the Commercial Secretary to H.M. Legation at Bukarest that an Industrial Reconstruction Company is being formed with the following objects:—To provide industry with machines, tools, raw materials, transport, &c.; to distribute raw materials that the State brings in as capital; to make advances to industrialists on favourable terms; to participate in the creation of industries beneficial to the nation; to contract loans and to discount bills. The capital of the company is fixed at 100 million lei, which is to be offered for subscription to industrialists of the country up to 50 per cent., by public subscription up to 20 per cent., and the remainder will be offered to industrial financial organisations now in existence.

Lead Report.—MESSRS. G. CAWSON & Co., reporting on October 30th, say:—"The market this week has not shown much change, except that the scarcity of prompt lead has become more pronounced, and prices have advanced 5s. to 10s. per ton. Meanwhile, forward lead has been inactive, there being apparently no fresh speculative demand to influence prices, while consumers continue their policy of only buying for actual immediate requirements. Closing prices are:—October and prompt, £36 5s. to £36 10s.; November, £36; December and January, £35 15s. If shipments do not increase, the outlook points to a very firm market during the next few months, particularly as strikes and labour difficulties seem now to be in a fair way of settlement, which naturally points to a larger consumption."

An After-War Reunion.—A very enjoyable evening was spent at the Queen's Hall, W., on October 28th, on the occasion of the staffs' after-war reunion of the Central Electric Supply Co., Ltd., the Westminster Electric Supply Corporation, Ltd., and the St. James's and Pall Mall Electric Light Co., Ltd. The entertainment, the programme of which comprised musical, vocal, and humorous items, was under the direction of Messrs. S. Green and S. G. Nodes. Whether these gentlemen were also responsible for the selection of artists we are unable to say, but whoever it was deserves congratulation on the choice made. During the interval Capt. E. J. Bax, chairman of the Westminster Co., and Mr. Walter Leaf, chairman of the Central and St. James's Companies, delivered short addresses of welcome to all those in the employ of the companies who had safely returned after serving in H.M. Forces during the war period, and paid tributes to those who had fallen in serving their country. We gather that the number of those who joined H.M. Forces was 307; the number of wounded was 45; and of those who made the supreme sacrifice 38. To quote the "Roll of Honour":—

"Who shall sing the song of Them:
The wonder and the strength of Them:
The gaiety and tenderness they bore across the sea:
In every heart's the song of Them:
The Chivalry and Fearlessness that strove to win her Free."

Mr. Vale-Lane's orchestra rendered much-appreciated musical selections during the evening, and the excellent programme was also contributed to by some two dozen artists, the majority of whom appeared by the kind permission of Mr. Charles Gulliver, of the London Theatre of Varieties, Ltd., and of Messrs. Grossmith and Laurillard. The Staff Entertainment Committee and its hon. sec., Mr. R. Litt, are to be congratulated on the way the entertainment was arranged and carried out.

Catalogues for Ghent.—H.M. Vice-Consul at Ghent reports the opening at the Vice-Consulate of a commercial information bureau and library for the use of callers. A special room has been set apart for the purpose, and the necessary facilities have been provided for the exhibition of United Kingdom directories, catalogues, and samples. H.M. Vice-Consul states that there is accommodation still outstanding for the display of a considerable number of catalogues &c., and he is accordingly open to receive copies from British firms which may be desirous of taking advantage of the remaining space available. He suggests, however, that such firms, before actually dispatching catalogues or samples, should communicate with him on the matter, so that the number and range of exhibits may be properly controlled and confined to suitable limits. He adds that catalogues may be in either English, French or Flemish, and should preferably be in book form. Loose sheets and price lists are not desired for the purposes of the present collection.—*Board of Trade Journal.*

West Midland Whitley Council.—An important Conference of representatives of local public authorities and staff organisations in the Midlands, called at the instance of the National Joint Council for Local Authorities' Administrative, Technical, and Clerical Services, was held at the Council House, Birmingham, on Wednesday last. The convener was the Lord Mayor of Birmingham (Alderman Cadbury), and the object was to consider a proposal for the formation of a Provincial Whitley Council for the Midlands. Invitations to the Conference were sent to 164 local authorities in Warwickshire, Worcestershire, Shropshire, Herefordshire, and Staffordshire, and also to the staff associations operating in the area. The Lord Mayor pointed out that the National Council was anxious to establish Provincial Councils and local Committees; 16 had been proposed, one of which would be centred in the West Midlands. Alderman Sir David Brooks moved that a Provincial Council, consisting of not more than 48 elected members be formed. Such Councils could perform very useful and valuable work in discussing the difficult questions of wages, hours, and conditions of service. While the Councils had no legal status, and no means of enforcing their decisions, his experience was that goodwill prevailed on the Councils, and there was a genuine desire on the part of both sides to arrive at decisions which would be just and fair. The whole basis of the scheme rested on goodwill and co-operation. The resolution was seconded by Mr. E. Hallas, M.P., who expressed the hope that the employers' side of the Councils would not be represented by officials or sub-officials. Alderman Goddard (Stoke-on-Trent) supported, and the motion was carried. Representatives were present from many gas, electricity supply, tramway, and other departments of municipal services.

New Rumanian Wireless Co.—Under the auspices of MARCONI'S WIRELESS TELEGRAPH CO., LTD., a new Marconi Co. has just been formed in Bukarest with a capital of 2,800,000 lei.

New Belgian Accumulator Co.—La Société Continentale de l'Accumulateur Edison is the name of a new company which has just been formed in Brussels (79, Rue Royale), with a capital of 1,200,000 fr., to handle the Edison accumulator on the Continent.

The Export Credits Scheme.—Mr. Kellaway (Secretary of the Department of Overseas Trade), in reply to a recent question put to him in the House of Commons, stated that the total amount of credits granted under the Overseas Trade (Credit and Insurance) Act to October 13th was £451,000, but some of these advances had been allowed to lapse, or had not yet been fully used. Mr. Kellaway further stated that as a result of the decision of the Government to increase the percentage of the cost of the goods to be advanced to the exporter from 80 to 100 per cent., many applications had been received for the advance of very large sums.

Electrolytic Smelting in Australia.—The immense possibilities for the electrolytic smelting industry in Australia have been demonstrated by a works established at Port Kembla (N.S.W.). Notwithstanding the comparatively recent foundation of the work, the present capacity for the production of electrolytic and fire refined copper is 44,000 tons.—*Reuter's Trade Service* (Sydney).

Electrical Developments in Japan.—Returns of the Department of Communications show that there were at the end of July, 778 electrical enterprises in Japan, involving a total capital of 1,218,390,961 yen. Their aggregate generating capacity is 1,303,551 KW.—*Reuter's Trade Service* (Tokio).

Government's Assistance to Trade.—The *Daily Telegraph* says that Mr. F. G. Kellaway, M.P. (Parliamentary Secretary, Department of Overseas Trade), speaking at a meeting on October 29th, described in some detail the assistance rendered by the Government to British traders in oversea markets. In the British Empire were 14 Trade Commissioners who rendered assistance to traders and sent in reports to the headquarters of the Department. In foreign countries the Commercial Diplomatic Service, consisting of about 50 officers, was engaged in this work, and was assisted by Consular officers in every place of importance throughout the world. Selection of suitable men was made by a representative committee of business men. In the headquarters of the Department of Overseas Trade the staff was engaged on the co-ordination of reports from representatives overseas for the guidance of British manufacturers occupied with export trading. Mr. Kellaway said that some idea of the magnitude of the work might be inferred from the huge amount of correspondence dealt with, amounting to between 15 and 20 thousand letters per week. This was in addition to a considerable number of inquiries made at the offices in person. A definite instance of an achievement of the Department was given by the speaker. A representative of an important British company reported that he had secured the first and most important post-war contract for the electrification of a section of the New Zealand Government railway. He attributed his success in a large measure to the great assistance rendered him by H.M. Trade Commissioner.

Coal Strike.—CORRECTION.—Mr. J. B. Feltham, electrical engineer for Mexborough Urban District Council, says:—"I wish to correct a statement in this week's issue of the REVIEW that the stock of coal here was sufficient for a fortnight's running. As a matter of fact, this department held at least six weeks' stock of coal at the beginning of the strike."

Lady Footballers.—The Ladies' Football Club connected with Messrs. Dick, Kerr & Co., electrical engineers, of Preston, were entertained on October 28th, prior to their departure for a tour in France. Mr. R. Livingstone, works manager, expressed the hope that the team would visit other countries where the firm had associations. It was stated that the club had been the means of raising over £8,600 for charities.

German Industry.—An Accrington commercial traveller, recently home from Germany, states that work is proceeding so briskly in the Fatherland, that the defeated nation will have captured half the trade of the world in 10 years. He adds:—"Whilst Germans are working and sweating, and getting rich by output, we have the opposite to contend with in England, owing to 'ca'canny.'"

Australia and Germany.—*The Times* Melbourne correspondent states that Mr. Hughes, asked in the House of Representatives whether he was in favour of resuming trade relations with Germany as other countries had done, replied with an emphatic negative. Germans in Australia should be dealt with fairly, however, and the question might be reviewed in, say, a year's time.

Imports from Germany.—*The Times* publishes the reply of the President of the Board of Trade to a question regarding German goods imported into this country, recently asked in the House of Commons. The figures given deal only with the first nine months of the present year, and do not contain any direct information about electrical goods. The total stands at £17,190,793, the main items in the list being coal-tar dyestuffs, commercial motor-cars, and toys and games. An item, "other goods," gives an amount of £8,090,755.

Emergency Orders.—The Board of Trade announces that the restrictions imposed by the Coal (Emergency) Order, 1920, the Lighting, Heating, and Power (Emergency) Order, 1920, the Gas and Coal (Emergency) Order, 1920, and the Coal and Fuel (Emergency) Order, 1920, remain in force until the Secretary for Mines shall by notice declare the state of emergency to have ceased. The notice will be published.—*The Times.*

French Export Trade.—Recent official returns of French exports and imports show that France is recovering her trade position rapidly. In the two years prior to the war exports averaged about 78 per cent. of imports. During the war this ratio fell as low as 22 per cent., and last year only rose to 25 per cent. In August of this year the percentage of exports to imports was 85, and this was fairly well maintained during September, when the figure was 81 per cent.

E.D.A. Activities.—The British Electrical Development Association has just issued a 19½ in. × 29 in. poster (E.D.A. 96) bearing the alliterative sentence "Use Electric Power for Progress and Production." The design is in subdued purple and orange, and consists of a number of pulleys on a shaft and countershaft. Inset is an electric motor, and another appears at the base of the poster. Space is left for the name and address of the exhibiting contractor.

British Empire Exhibition.—In the House of Commons on Monday the second reading was carried by 205 to 30 of the British Empire Exhibition (Guarantee) Bill. The Bill provides for a guarantee by the British Government of £100,000, subject to private guarantees being obtained amounting to £500,000. The exhibition will be held in 1923 and is intended to be thoroughly representative of British Imperial trade.

Physical Society's Exhibition.—The dates of the Eleventh Annual Exhibition are provisionally fixed for January 5th and 6th, afternoon and evening.

Industrial Co-partnership.—On October 26th, at the Royal Society of Arts, a number of public men, representatives of industry and labour, met at a Labour Co-partnership Congress. Lord Robert Cecil, M.P., presided, and among the speakers were Mr. J. H. Whitley, M.P., and Mr. Wardle, M.P. Lord R. Cecil stated that a great deal of trouble was due to the misconception that the business of an undertaking belonged solely to the owner of that undertaking; but the essential of business was formed by an agreement of partnership between Capital and Labour. Mr. J. H. Whitley thought that the phrase, "masters and men," was out of date, and the real description of people working together in industry should be "fellow workers all." Mr. Wardle said that to make labour co-partnership successful, the Trade Union movement must be more intimately connected with the work. He wanted to see the problems of the future worked out by employers and employed together. Many schemes when put into operation did not mean real co-partnership, and the workers were not yet convinced that co-partnership was anything but mere camouflage. What the people and their Trade Unions were out for was some real power of direction and responsibility.

Austrian Property.—The Administrator of Austrian Property draws attention to the provisions of the Treaty of Peace (Austria) Order published in the *London Gazette* of August 20th last, which, among other things, prohibits transfers, &c., of the property of Austrian nationals without the consent of the Administrator, and orders the notification, by persons controlling or owning such property, of details to the custodian.

Oil in Arctic Canada.—According to the reports of geologists, and the admissions of the Imperial Oil Co., the new oil-field near Fort Norman is one of the richest ever discovered. But as Mr. Stillman, the president of the Imperial Oil Co., points out, the well is 1,500 miles north of Edmonton, and 1,200 miles from the nearest railway. While, therefore, its discovery is important and of much value scientifically, it is not of immediate commercial utility, and it may possibly be years before oil from the field can be made available in quantities in Canadian markets.—*The Times.*

LIGHTING AND POWER NOTES.

Accrington.—STAFF SALARIES.—The National Board of Employers has communicated with the Council urging the necessity of carrying out its recommendations regarding salaries and conditions of its electrical staff. At present it was stated the three superintendents earned £360 each. The new rate would increase this to £469, rising by annual increments to £523. The senior charge superintendent received a salary of £312, which under the new rate would be increased to £349; the shift engineers from £294 to £329, increasing by instalments to £349; draughtsmen £280 to £313, increasing to £349; 14 days' holiday with pay, and payment for sickness according to length of service. The Council approved the scale, but referred back the holiday and sick pay clauses. As the Accrington works would be increased by 5,000 KW. this year, Alderman Higham said the increases would be even more.

Bingley.—ARBITRATION.—Mr. S. E. Fedden, general manager and engineer of the Sheffield electricity department, has been appointed as the arbitrator in connection with the District Council's recent action complaining of the frequent stoppages of bulk supply of electricity by the Keighley Corporation, which is alleged to have failed in fulfilling its agreement obligations. The Corporation has instructed its officials to agree with the Bingley Council upon terms of reference, and to take such further steps as may be deemed necessary.

Bispham.—AMALGAMATION.—The electricity works has closed down, the consumers having been transferred to the Blackpool system following the amalgamation. The old plant is being offered for sale. The Blackpool mains are being extended.

Chesterfield.—GROWTH OF UNDERTAKING.—It was stated at a recent Council meeting that the output of the electricity works had risen from 1,787,100 units in 1914, to 4,414,150 in 1919-20.

Cleckheaton.—PRICE REVISION.—The District Council announces that from November 1st the electricity prices to ordinary consumers will be at the flat rate of 5d. and 2½d. per unit less the present sliding scale of discounts. The price is slightly in favour of the consumer, and is in substitution of the method of calculation hitherto in force.

Colne.—Loan Sanctioned.—The Town Clerk reported to the Council, on October 28th, receipt of sanction to borrow £19,636 for the extension of the town's electrical undertaking, the Commissioners intimating that they would be prepared to consider an application for sanction to any further sums.

Continental.—Finland.—*Svenska Dagbladet* learns from Helsingfors that the Finnish Government is preparing plans for the efficient utilisation of the water-power of the country for industrial purposes. It is intended to establish a large power station which will supply the entire South of Finland.—*Reuter's Trade Service* (Stockholm).

France.—The Paris *Daily Mail* states that M. Le Trocquer, French Minister of Public Works, is visiting the Savoie district in order to inspect the chief hydro-electric installations in that region, and to study the means by which a better utilisation of hydraulic power might be ensured generally.

Crieff.—Electricity Supply.—Following an exhaustive report on the proposal to introduce electric lighting in the Burgh of Crieff by Mr. MacEwan, consulting engineer, and a successful electrical exhibition demonstrating the advantages of electricity, considerable public support is being accorded the scheme.

Dewsbury.—Staff Salaries.—The Corporation Electricity and Tramway Committee has decided that it cannot recommend the payment to the electricity works staff of the recent award of the Joint Board of Technical Staffs.

Dover.—Public Lighting.—The Town Council is having prepared a scheme for lighting the entire town by electricity on the expiration of the agreement with the Gas Co. on March 31st, 1922.

Electricity Districts.—The Electricity Commissioners have provisionally determined that the undermentioned areas shall be constituted separate electricity districts for the purposes of the Electricity (Supply) Act, 1919 :—

South Wales.—The Counties of Brecknock, Carmarthen, Glamorgan, Pembroke and Radnor.

So much of the County of Cardigan as is included in the Municipal Boroughs of Cardigan and Lampeter; the Urban Districts of Aberayron and New Quay; the Rural Districts of Aberaeron, Cardigan, Lampeter, Llandyssul and Tregaron.

So much of the County of Monmouth as is included in the County Borough of Newport; the Municipal Borough of Abergavenny; the Urban Districts of Abercarn, Abersychan, Abertillery, Bedwas and Machen, Bedwellty, Blaenavon, Caerleon, Ebbw Vale, Llantarnam, Llanvrechva Upper, Mynyddislwyn, Nantyglo and Blaina, Panteg, Pontypool, Rhymney, Risca, Tredegar and Usk; the Rural Districts of Abergavenny, Magor, Pontypool and Saint Mellons.

East Midlands.—So much of the County of Derby as is included in the County Borough of Derby; the Municipal Borough of Ilkeston; the Urban Districts of Alfreton, Alvaston and Boulton, Ashbourne, Belper, Heage, Heanor, Long Eaton, Ripley, Swadlincote District and Wirksworth; the Rural Districts of Ashbourne, Belper, Hartshorne and Seals, Repton, Shardlow and Sudbury.

So much of the County of Leicester as is included in the County Borough of Leicester: the Municipal Borough of Loughborough; the Urban Districts of Ashby-de-la-Zouch, Ashby Woulds, Coalville, Melton Mowbray, Oadby, Quorndon, Shepshed, Thurmaston and Wigston Magna; the Rural Districts of Ashby-de-la-Zouch, Barrow-upon-Soar, Belvoir, Billesdon, Blaby, Castle Donington, Loughborough, Market Bosworth and Melton Mowbray.

So much of the County of Nottingham as is included in the City and County Borough of Nottingham: the Municipal Boroughs of Mansfield and Newark; the Urban Districts of Arnold, Beeston, Carlton, Eastwood, Hucknall Torkard, Huthwaite, Kirkby-in-Ashfield, Mansfield Woodhouse, Sutton-in-Ashfield, Warsop and West Bridgford; the Rural Districts of Basford, Bingham, Leake, Newark, Skegby, Southwell and Stapleford.

So much of the County of Stafford as is included in the County Borough of Burton-upon-Trent: the Rural District of Tutbury, except the portions known as Tutbury Rural District detached No. 1 and Tutbury Rural District detached No. 2.

Local inquiries into the existing organisations for the supply of electricity in the above-mentioned districts are to be held on dates to be announced later. Objections, representations, or schemes for the improvement of existing supply organisations may be made to the Commissioners not later than April 30th, 1921, in the case of the South Wales district, and not later than March 31st, 1921, in the case of the East Midlands district.

Finchley.—Developments.—It is stated that a sum of £60,000 is to be expended on the development of the municipal undertaking. The scheme includes linking up with the neighbouring borough of Hornsey.

Glossop.—Purchase Declined.—The Town Council has declined an offer of terms for the purchase of the undertaking of the Urban Electricity Supply Co., Ltd.

Huddersfield.—Prov. Order.—The Town Council has resolved that application be made to the Electricity Commissioners for a special order under the Electricity (Supply) Acts, 1882 to 1919, authorising the Corporation to supply electricity for all public and private purposes within the urban districts of Kirkheaton, Kirkburton, Lepton, and Meltham.

Keighley.—Loan.—The Electricity Committee has recommended the borrowing of £30,000 for the electricity undertaking. Of this sum £9,000 is in respect of excess expenditure on converting plant (£1,000), water-tube boiler (£800), and boiler-house equipment (£7,200), and the balance is the estimated expenditure for the next two years, made up as follows:—New mains, £10,000; motors on hire, £3,000; services, £5,000; and sub-station equipment, £3,000.

Kirkintilloch.—Electricity Supply.—The Clyde Valley Electric Power Co., having got the necessary guarantee in Kirkintilloch, is extending cables into the district for the supply of power, and is to erect a transformer sub-station.

Liverpool.—Extensions.—The Electric Power and Lighting Committee has given authority for the extension of low-pressure A.C. mains to Breeze Hill, at an estimated cost of £1,100, and for the fixing of a transformer and switchgear in the Walton Town Hall sub-station at an estimated cost of £500. In addition, 30 further extensions to mains have been sanctioned.

Lancaster.—Breakdown.—A breakdown of plant at the Corporation electricity works on October 31st, plunged the town into darkness and interrupted several church services.

Leith.—Price Reduction.—It is reported that as a consequence of amalgamation with Edinburgh, the electricity charges in Leith will be reduced to the same level as those in Edinburgh; this will mean a reduction of ½d. per unit for lighting, and 1½d. for power. This, it is anticipated will probably cause a loss to the joint undertakings.

London.—It was reported that as a result of damaged and flooded mains during the recent fire at the Hop Exchange, the supply voltage to a number of buildings was augmented to such an extent that many electric lamps blazed up, the filaments fused and the glass bulbs broke.

North Wales.—Electricity District.—Carnarvonshire County Council had before it at its last meeting resolutions from conferences of various authorities opposing the proposed scheme of the Electricity Commissioners, by which portions of Shropshire, Cheshire and Cardigan are to be included in the North Wales area. One reason urged was that North Wales should have first claim on its natural resources. Details of important developments contemplated by the Aluminium Corporation were outlined by its managing director, Mr. H. J. Jack, who pointed out that he was prepared with a scheme to supply every town, village and large farm in the whole of North Wales with electricity in a few months from that day. The companies which he managed had already spent £2,000,000, and in order to ensure full development, a further expenditure of £3,000,000 would be required. They had acquired the option of the best watersheds in North Wales. None of the ordinary shareholders had received a penny profit during the last 12 years. While he reminded the County Councils of the enormous financial responsibility which the establishment of a joint electrical authority would involve, he expressed his readiness to support such authority to the fullest extent. The Council decided to refer the question to its Reconstruction and Parliamentary Committees.—*Financier.*

Norwich.—Proposed New Station.—A thorough reorganisation of the electricity supply was outlined in a report recently placed before the City Council by the Electricity Committee. It is proposed to erect a new station on a piece of land between the river and the Great Eastern Railway, at an estimated cost of £502,000. The present works would be kept in commission as a generating station for a few years, but would then be employed as a sub-station housing converter plant. After some discussion the report was referred back to the Electricity Committee for further details.

Plymouth.—Loan Sanctioned.—The Electricity Commissioners have given the Corporation permission to borrow £46,221 for mains and £8,095 for plant.

Stoke-on-Trent.—Cable Extensions.—A total of £9,900 is to be expended on cable extensions, comprising a new feeder at Longton (£6,000), a feeder in Stoke, and an interconnecting distributor at Penkhull. Sanction is being sought to a loan of £2,445 for the purchase of land in Marsh Street, Hanley, on which a sub-station is to be erected.

Torquay.—Electricity District.—The Electricity Commissioners suggest that the funds for the erection of a new power station should be raised locally, but great difficulty is anticipated by the Council. It is thought that either the Commissioners should contribute part of the cost or neighbouring towns which would benefit by the scheme should participate in the provision of the necessary £250,000.

Willesden.—Year's Working.—The statement of accounts for the year ended March 31st last shows that the total revenue accruing to the Electricity Fund was £77,349, as compared with £57,509 for the previous year. Working expenses amounted to £51,615, against £59,117, leaving a gross profit of £25,734, compared with a deficit of £1,608 last year. The net profit after payment of capital charges was £8,314.

Witham.—Electricity Supply.—The East Anglian Electricity, Ltd., has informed the Urban District Council that it proposes to construct a high-tension line along the railway to supply electricity to Braintree and Witham.

Yorkshire.—Electricity Supply.—At the County Hall, Wakefield, on Oct. 29th, a conference was held between the County Council and representatives of local authorities to discuss questions arising out of the Electricity (Supply) Act of 1919. A sub-committee was formed to consider the whole matter and to find the most effective way of achieving the objects of the Act and an efficient and economic supply of electricity for power and lighting. —*Leeds Mercury.*

TRAMWAY AND RAILWAY NOTES.

Bacup.—Protest Against Fare Increase.—At a recent meeting of the Town Council it was stated that Rawtenstall Corporation had secured an interim order from the Ministry of Transport, permitting the Corporation to increase the fares on the tramways for a period of six months. This was done without the knowledge and consent of the Bacup Council, and the action was subjected to severe criticism. A Bacup alderman announced that he had refused to pay the increase, and advised the ratepayers to do the same, as the part of the system leased to Rawtenstall by Bacup was a remunerative section, and the increase was therefore not justified. The report of the Electricity Committee, questioning the legal right of Rawtenstall to raise fares without consulting Bacup, was adopted.

Barrow.—Electric Vehicles.—The Corporation proposes to purchase four additional electric wagons at a cost of £5,300 for the Health Department.

Birmingham.—Stoppage.—The tramway service was dislocated on October 29th owing to a short circuit in the high-tension system at the Summer Lane electricity station, affecting the sub-stations. On some portions there was a delay of 40 minutes.

Burnley.—Motor Services.—The Town Council proposes to apply for permission to run motor-omnibuses along the tramway routes supplementary to the car service, particularly for use in the event of a breakdown.

Continental.—Belgium.—Brussels tramway men, says *Le Peuple*, are holding a secret ballot on the question of an immediate strike, their demand for more pay having been refused. —*Daily Mail.*

Dublin.—Curtailment of Services.—Owing to coal shortage, the Dublin United (Electric) Tramways Co. was obliged to close down, from October 31st, the Kenilworth Square and Lansdowne Road, Sandymount (Francis Street), and South Quays lines, and to reduce the service generally.

Durham.—Development Scheme.—An ambitious scheme for road transport is being considered by Durham County Council, which, if the proposals are carried out, will cover the most thickly-populated parts of the county with a network of tramways and other electrically-propelled vehicles. The question of the expediency of promoting a Bill in the present session of Parliament will be considered shortly. The main suggestions are that tramways should be constructed to join with the Gateshead company's service passing through Chester-le-Street, Durham City, to Langley Moor, Meadowfield, and Spennymoor. Another route would go through Framwellgate Moor to Neville's Cross, and a route would commence from the Gateshead company's terminus at Heworth, and pass through Hebburn and Jarrow, connecting there with the existing light railway to Tyne Dock and South Shields. A branch from this route is proposed to Boldon Colliery and thence to Cleadon.

Employés' Wages.—Inquiry.—At a recent meeting of the National Joint Industrial Council for the Tramways Industry, it was agreed by both employers and workers that an inquiry should be made by the joint secretaries into the circumstances connected with the claim of employés for a further advance of 12s. a week for adults and 6s. a week for employés under 18 years of age. The principal points of investigation are the relation of increases already granted to the present cost of living and the effect of increased fares upon the financial position of tramway undertakings. The Board will meet again to receive the secretaries' report on November 12th.

Haslingden.—Loan Sanctioned.—At Haslingden Town Council, on October 27th, it was reported that the Ministry of Transport had sanctioned a loan of £2,600 for the provision of a rotary converter and switchboard extensions. It was reported that Rawtenstall Council had agreed to through running of the tramway service between Accrington and Rawtenstall for a further period of 12 months.

India.—Strike Riots.—Tramway strikers at Bombay have resorted to indiscriminate stone-throwing and, whenever possible, are holding up tramcars. There have been several casualties, and one man was stoned to death.—*The Times.*

Liverpool.—Improved Trolley.—A new safety electric trolley device for the Corporation tramcars is under the consideration of the Tramways Committee.

Preston.—Working Losses.—At a meeting of the Town Council on October 28th, it was stated that for some months the tramway had been working at a loss. During the last six months there had been a deficit of £6,000, and unless there was an improved income, the loss at the end of the ensuing half-year would be £10,000; £8,000 more was required for wages, and the cost of materials had gone up 200 per cent., whilst fares had only increased 50 per cent.

Rochdale.—Proposed Purchase.—A Sub-Committee has been appointed to consider and report upon the acquisition of the Middleton tramways, and with a view to a conference with representatives of the Middleton Corporation and Chadderton Urban District Council.

St. Annes.—Tramway Purchase.—The Blackpool, St. Annes, and Lytham Tramway undertaking has now passed from a public company into the possession of the St. Annes District Council, and on October 28th Mr. C. E. Critchley, chairman of the Council, handed over a cheque for £144,936 to the chairman of the company. The sums agreed upon were £135,000 for the undertaking, £4,866 for interest, and £5,000 as compensation. Mr. Nicholson, the chairman of the company, stated that in the year just ending there had been record receipts, but the expenses were much heavier than ever before.

Swansea.—Extension of Time.—The Minister of Transport has extended the time of the Swansea Corporation Act, 1912, for the completion of the tramways until August, 1921.

TELEGRAPH AND TELEPHONE NOTES.

A New Cable Ship.—The fleet of cable ships owned by the Eastern Telegraph Co., which inludes the *Cambria, Transmitter, Amber, Britannia, Lecant II, Electra, Sherard Osborn,* and *John Pender,* has been increased by the addition of the new steamer *Lady Denison-Pender.* The vessel, which was launched on the Clyde on May 29th last, has been specially designed for laying and repairing submarine cables. She is of the shelter-deck type, with a long bridge, cruiser stern, and twin screws; is 282 ft. 8 in. long, 38 ft. wide, and 25 ft. in depth to the shelter deck. She is of 2,000 tons gross and 1,900 tons carrying capacity, on a draught of 17 ft. 6 in., and at a speed of 12 knots. The ship is rigged as a two-masted schooner, with two 5-ton derricks on the fore-mast. There are three cable-tanks, having a total capacity of 20,830 cb. ft., which is equivalent to 600 nautical miles of cable. There are also two sets of cable-working machinery, with bow-sheaves of an improved pattern. There is accommodation for a complement of 100 persons, with hospital, surgery, cable testing-room, chart-room, workshop, &c.

Argentina.—New Telephone Company.—The American International Western Electric Co. has organised a new company to take care of the telephone requirements in the lower part of South America, and is to be known as the Companis Western Electric Argentina, with headquarters at Buenos Aires. Previously all telephone supplies for Argentina and her neighbours have been imported.

Australia.—Secret Wireless.—Mr. Macdonald, a former Lieut.-Commander of Telegraphists in the Australian Navy, has left for England to submit to the Admiralty the details of an invention for sending wireless code messages without danger of interception by the enemy.—*Reuter's Trade Service* (Melbourne).

Belgium.—New Wireless Station.—The Administration of Posts, Telegraphs, and Telephones announces that contracts may now be submitted for the building of an inter-Continental wireless station, which it is intended to make one of the most powerful in the world. It is intended that the Belgian transmitting station shall be in permanent communication throughout the 24 hours with American stations while a 12-hours' service is to be maintained to the Argentine, and an 8-hours' service to the Congo, the latter service being necessarily of shorter duration by reason of the adverse atmospheric conditions which prevail in equatorial regions during the greater part of the day. Belgium is some 3,750 miles from the United States, and from the Congo, and about 6,875 miles from Argentina. The transmission of 1,800,000 words per month is to be provided for, that is, an average of 60,000 a day, divided as follows:—35,000 to the United States, 10,000 to South America, and 15,000 to the Congo. The station will probably be of from 700 to 1,000-kw. capacity, and will either be supplied by a special power station or from one or two distributing stations already in existence. The antennæ will be supported by eight steel pylons, each 250 metres in height, that is, only 50 metres less than the Eiffel Tower. The antennæ and the surrounding buildings will occupy a space of about 250 acres, and the station is to be erected in Flanders. The apparatus will receive messages of widely varying wave lengths, and a service in both directions will be maintained at the same time, the receiving station being in no way hindered by the transmitting station a few hundred yards away. It is intended to construct a

multiple transmitting station so that messages may be sent simultaneously to the United States, Argentina, and the Congo.—*Reuter's Trade Service* (Brussels).

Canada.—Wireless Telephony.—The British Columbia Forestry Branch has recently closed a contract with the Marconi Wireless Telegraph Co., of Canada, for the installation of four land stations and five launch equipments, for use in forestry fire protection work. One station, at the Forestry Office in Vancouver, is already installed, and the first installation on one of the small motor boats has been placed. Successful tests have been carried out between these two stations at distances varying up to 75 miles. On account of the rugged character of the coast country this distance is the limit of the radius to be attempted for the present, although the extreme radius of the wireless telephone is stated to be 300 miles over flat land or over water.

Germany.—Long-Distance Telephony.—On April 1st, 1914, direct telephone communication between Berlin, Frankfort-on-Main and Milan, through the Simplon Tunnel, was opened. The distance, 1,350 kilometres, was longer than that between Berlin and Paris, 1,198 kilometres. On the outbreak of war telephone communication between Germany and Italy was broken off. The direct line between Berlin and Milan was utilised thenceforth for the development of telephone communication between Berlin, Frankfort-on-Main and Switzerland, and the traffic assumed extraordinary proportions. When relations between Germany and Italy were resumed in 1919, it was found that many difficulties had to be overcome before the telephone line between Berlin and Milan could be restored to its original use. The Swiss Telegraph Administration demanded a separate and complete system, but though many attempts were made this could not be made available with the existing lines owing to the extraordinary growth of traffic in the interval. The construction of a completely new telephone line between Frankfort-on-Main and Zurich had to be faced, and this line has already been completed as far as the Swiss frontier. Meanwhile, the re-opening of direct communication between Berlin and Milan has had to be postponed.

New Mexico.—Wireless Telephony.—Wireless telephones are being installed in the forests near Albuquerque, and if they prove satisfactory, they will be installed in all the forests of the district.

Spain.—Government Telephone Control.—Government supervision of the telephone system, says the *Telephone Engineer*, has been decided upon owing to the incessant complaints of bad service given by the company now possessing the monopoly. In the event of the complaints being justified, the Government will revise the concession, and possibly take over the whole system.

Submarine Cables.—Requests for information regarding submarine cables having been received from many quarters, the *Post Office Electrical Engineers' Journal* proposes to publish lists of the more important ones, illustrating a few of their chief features. A commencement is made in the October, 1920, issue (Vol. XIII, Part 3), with details of the 47 telegraph and telephone cables worked by the British Post Office, from which it is seen that the oldest cable was laid in 1851; one cable was laid in 1914; one in 1916; five in 1917; and three in 1918. The lengths of cables vary from 20 to 1,354·65 nautical miles; the resistance from 90 to 4,309 ohms; and the capacity from 6 to 843 mf.

Switzerland.—League of Nations' Wireless Installation.—With further reference to our recent note under the above heading, the *T. and T. Age* states that the Swiss Federal Government is receiving bids for the installation of a wireless telegraph station at Geneva, in view of the convocation there this month of the League of Nations. The Marconi Co., of London, proposed to construct by November 1st a 6-kw. station, at a cost of £10,400, but as such a station would have insufficient carrying power, the proposal was rejected. Until better means of wireless communication from Geneva become available, two proposals have been made: One is to send telegrams by ordinary telegraph lines to Lyons to be relayed from there to all parts of the world. A second proposal is to utilise the Lyons station, by the use of a special wire, directly from Geneva. This would require the consent of the French Government, which has been requested. Meanwhile, the study of the question of a permanent station continues. It is believed that the construction of a station of equal power to that of Nauen would cost more than $4,000,000. One firm has, however, proposed to install a station equivalent in power to the Nauen station, but less complete, for approximately $1,000,000. It would be necessary to add to this sum an expenditure of about $150,000 for the housing of the apparatus.

United States.—Loud-speaking Telephone.—The Western Electric Co. recently established telephonic communication with an outgoing steamer without the aid of receiving apparatus. The passengers of the Cunarder *Imperator* were amazed as they sailed down the North River towards the Narrows to hear a deep voice boom out, apparently from nowhere, "Steamship *Imperator*, ahoy!" The call, says the *T. and T. Age*, "might have been that of a New York bellbuoy, only there was a difference—it was intelligible." The transmitter was set up in a tenth-floor window of the Western Electric Laboratories at West Street, New York.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review, *in which the "Official Notice" appeared.)*

OPEN.

Australia.—January 19th, 1921. Victorian Railways Department. Supply, delivery, and erection and testing, or, alternatively, supply and delivery of electric furnace and equipment, and/or, alternatively, for supply and delivery of equipment, and drawings for electric furnace. Particulars from the Agent-General for Victoria, London, S.W.—*Tenders.*

Western Australia.—December 28th. Postmaster-General's Department. Telegraph and telephone instruments and parts. (Schedule 689).

Belgium.—November 9th. Municipal authorities of Antwerp. Electrical plant. Specification from the Hotel de Ville, Antwerp.

November 8th. The Directeur-General of the Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Construction of a new sub-station at Middlekerke.

December 14th. The municipal authorities of Antwerp. Supply of a set, comprising electric motor and pump, for the raising of the bridge over the Royers Dock. Specifications can be obtained, at a cost of 2 francs, from the Hotel de Ville, Antwerp.

Bradford.—Tramways Committee. General stores and electrical equipment for 12 months. The Manager.

Board of Guardians:—

Electric passenger lift for St. Luke's hospital.—Fred. Holland, engineer and architect, 22, Manor Road, Bradford.

Dublin.—November 16th. G. N. Railway Co. (Ireland). 12 months' supply of general stores, including electrical fittings, lamps, cable and wire, &c. (October 29th.)

Falkirk.—November 13th. Parish Council. Supply of stores for Blickbonny Home, including electric lamps. Mr. J. Macpherson, the Governor.

France.—November 19th and 26th. French State Railway authorities, Rue de Rome, Paris. Electrical material for the Ouest-Ceinture sub-station; two electrically-operated travelling cranes at the La Garenne electrical repair shops. Particulars from the Service Electrique, 88, Rue de Rome, Paris.

Boulogne-sur-Mer.—November 16th. Chambre de Commerce. Supply and erection of six large electric travelling cranes for the Nord Quay of the Loubet Dock, Boulogne-sur-Mer.

Manchester.—November 8th. Electricity Committee. Supply and erection of high- and low-pressure steam, feed, &c., pipework—including alterations to existing pipework, &c. (October 15th.)

November 22nd. Electricity Department. Motor-generators, battery boosters and switchgear. (October 22nd.)

New Zealand.—January 17th. Napier Municipal Council. Supply of one 500-kw. gas-electric generating set.—*Reuter's Trade Service* (Wellington).

Stockton-on-Tees.—November 15th. Electricity Department. One new traction switchboard; one rotary converter panel and busbars. (See this issue.)

CLOSED.

Australia.—Department of Treasury. Accepted:—

One each ½ h.p., 1 h.p., 2 h.p. and 3 h.p., 3-phase, squirrel-cage motors, and one 5 h.p., 3 phase, slip-ring motor, £179.—Australian General Electric Co.

P.M.G.'s Department, N.S.W.:—

Material and apparatus for City North Automatic Telephone Exchange, £71,508, Automatic Telephones (Australia), Ltd.; £1,816, L. P. R. Bean; £1,231, Accumulators, Ltd.

P.M.G.'s Department, S.A.:—

14 group selectors, 18 second-line finders, 20 auto "B" circuits. £875.—Western Electric Co. *Tenders.*

Blackpool.—Electricity Committee:—

British Niclausse Boiler Co., for the supply and fixing of two boilers at the electricity works, subject to the Commissioners approving a loan of £12,500.

Barnstaple.—Town Council:—

Repairing No. 1 engine at the electricity works.—Reavell's (Ipswich), £450 to £475.

London.—Stepney.—Electricity Committee. Recommended. Four D.C. ammeters for the Osborn Street switchboard.

Kelvin, Bottomley & Baird	£164—Recommended.
Crompton & Co.	176

Two pairs of 5000-amp., watt-hour meters, £218.—Aron Electricity Meter, Ltd. Recommended.

Oil extractor waste washer, £164.—Industrial Waste Eliminators, Ltd. Recommended.

10-ton lot of troughing composition, £165.—Dussek Bitumen Co. Accepted.

Hythe.—Correction.—The amount of the accepted tender, of Messrs. J. Pain & Co., for the electric light installation at the municipal houses was at 28s. 6d. a point, not 38s. 6d. as inadvertently stated last week.

FORTHCOMING EVENTS.

Motor Exhibition.—November 5th to 13th. At Shepherd's Bush, W., and Olympia, W.

Institution of Mechanical Engineers.—Friday, November 5th. At the Institution, Storey's Gate, S.W. At 6 p.m. Thomas Hawksley lecture on "Limit Gauging," by Sir R. T. Glazebrook, F.R.S.

Edinburgh Electrical Society.—Friday, November 5th. At the Philosophical Institution, Queen Street. At 8 p.m. Paper on "Some Incidental Uses of Electricity," by Mr. B. A. Pilkington.

Junior Institution of Engineers.—Friday, November 5th. At Caxton Hall, Westminster. At 8 p.m. Lecturette on "Some Further Locomotive History," by Mr. E. Hooper.

Shipbuilding, Engineering and Electrical Exhibition.—November 8th to December 4th. At the Kelvin Hall, Glasgow.

Institution of Post Office Electrical Engineers.—Monday, November 8th. At the Royal Society of Arts, John Street, Adelphi. At 7.30 p.m. Paper on "The Influence of Traffic on Automatic Exchange Design," by Mr. G. F. O'Dell.

Societe des Ingenieurs Civils de France.—Tuesday, November 9th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8.30 p.m. Paper on "The Destruction of the Mining Districts of Northern France and the Work of Reconstruction," by Mr. E. Gruner, President.

Paisley Association of Electrical Engineers.—Wednesday, November 10th. At the Y.M.C.A. Buildings, 25, High Street. Paper on "Paisley Corporation Electricity Undertaking," by Mr. W. Blair-Smith, Engineer and Manager, Corporation Electricity Department.

Institution of Electrical Engineers.—Thursday, November 11th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Inaugural address by the President, Mr. Li. B. Atkinson. Presentation of premiums.

(**North-Eastern Centre.**)—Monday, November 8th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Inaugural address by the Chairman, Mr. J. R. Beard.

(**Scottish Centre.**)—Tuesday, November 9th. At 207, Bath Street, Glasgow. At 7.30 p.m. Inaugural address by the chairman (Mr. J. E. Sayers).

(**Students' Section.**)—Friday, November 12th. At the Royal Technical College, Glasgow. At 7.30 p.m. Chairman's (Mr. F. H. Wysall) address.

(**Western Centre.**)—Monday, November 8th. At the Merchant Venturers' Technical College, Bristol. At 7 p.m. Inaugural address by the Chairman, Mr. A. J. Newman.

Electro-Harmonic Society.—Friday, November 12th. At the Great Hall, Cannon Street Hotel, E.C. At 8 p.m. Ladies' night.

Physical Society of London.—Friday, November 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Association of Engineers-in-Charge.—Friday, November 12th. At the Crown Room, Holborn Restaurant. At 6 p.m. Ladies' night.

Manchester Association of Engineers.—Saturday, November 13th. At the Memorial Hall, Albert Square. At 7 p.m. Paper on "The Education Act of 1918 as it affects the Engineering Industry," by Mr. S. Hey. Discussion on "Liquid Pressure of Iron in Moulds," introduced by Mr. A. H. Goodger.

Birmingham Electric Club.—Saturday, November 13th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Some Aspects of Modern Works' Management," by Mr. H. C. Young.

NOTES.

The Electro-Harmonic Society.—At the concert (Ladies' Night) to be held on Friday, November 12th, at the Cannon Street Hotel, commencing at 8 p.m., Mr. Li. B. Atkinson (President of the Institution of Electrical Engineers) will be in the chair. Artistes: Miss Marion Brown, soprano; Miss Edith Furmedge, contralto; Mr. David Ellis, bass; Mr. Norman Long, humorist; Mr. Robert Pitt and Mr. Langton Marks, duettists. An orchestra consisting of members of the London Symphony and principal London orchestras has been provided by Mr. Atkinson; conductor, Mr. Charles Woodhouse, musician-in-ordinary to the King. At the piano, Mr. Bernard Flanders, A.R.A.M.

Electrical Developments in Spain.—According to statistics drawn up by an expert, the power represented by existing hydro-electric installations in Spain is as follows:—

	Total H.P.
Plants of 800 H.P. and over	577,192
" " 300 to 800 H.P.	28,162
" " Less than 300 H.P.	13,402
Total ...	618,756

Plants under construction, reckoning only those exceeding 5,000 H.P., represent an additional 259,000 H.P., and the demand for hydro-electric concessions is always considerable. The output before the war was only 150,000 H.P., and the prospects of hydro-electricity are considered to be very bright.—*Reuter's Trade Service* (Madrid).

New Fire Signal Telegraph.—The L.M. Ericsson Telephone Co., of Stockholm, has placed on the market a new fire signal telegraph which, it is reported, will surpass all previous systems in efficiency, reliability and cheapness. The new system is a development of Ericsson's older type of telegraph.—*Reuter's Trade Service* (Stockholm).

Electro-Medical Gift.—The formal handing over of electric lighting and X-rays installations gifted to Blairgowrie and Rattray District Cottage Hospital (Perth) by Mr. David Henderson, Ericht Lodge, Rattray, and which has cost £1,500, took place on October 28th.

Power Factor.—The following should be added to Mr. Turnbull's article in our last issue:—

"Fig. 6 shows what happens when an inductance, without resistance, is connected across the conductor. The current acquires a momentum when the conductor is travelling from the mid point to the circumference, during which time energy is absorbed from the engine which drives it. The current reaches its highest value when the conductor gets to the end of its travel, when the voltage is zero. On the return of the conductor to the mid-point, the current, owing to its momentum, persists in the same direction, and drives the conductor, which in turn drives the engine. By the time that the conductor has arrived at the mid point, the current has come to a stop, and for the remainder of the motion, it builds up momentum in the opposite direction. The use of the word "wattless" as applied to such cases is misleading to beginners. The proper description of wattless current is that it returns as much energy to the mains as it draws from them. A similar wattless effect is obtained when a heavy pendulum is swinging to and fro. The energy is there all the time, as one can find out by interfering with its motion.

"The severe remarks of certain critics, on the Banking Analogy, are puzzling. Perhaps the critics think that the analogy is intended for students. Such a purpose would be absurd, as technical students are not usually so immersed in banking matters that such an analogy would appeal to them. For business men, however, the simile has its advantages, and doubtless it will be heard of in the future."

Swedish Hydro-Electric Works.—Mr. Carl A. Rossander, discussing the question of the supply of electric power and of coal before the Swedish Technological Association at Stockholm on October 23rd, mentioned that the electrical department of the State Railways had made calculations showing that it would be advantageous to convert all the State Railways to electric traction, even with a coal price of from 50 to 100 kroner per ton, as compared with the present rate of 150 kroner. It was probable that the situation of the privately owned railways was not materially different in this respect. If all the State and private railways were converted, it was estimated that the annual consumption for this purpose would be about 475,000,000 KW.-hours.

German Diesel Engines.—In connection with the misunderstandings which the Diesel engine question appears to have given rise to, judging from articles published in the German Press, Reuter's correspondent learns in well-informed British quarters that there is no intention whatever to destroy other Diesel engines than the submarine engines, neither is there any idea of destroying Germany's Diesel engine industry. The matter has been referred to the Allied Governments, and is, therefore, *sub judice*. Meanwhile, the destruction of all submarine Diesel engines has been postponed until the Allies have come to a decision in the matter.—*Reuter's Trade Service* (Berlin).

Automatic Train Control.—Arising out of the recent experiments with automatic railway train control (see p. 570 of our last issue) a Special Committee to consider the system's possibilities has, says the *Daily Telegraph*, been appointed, under the chairmanship of Colonel J. W. Pringle, Chief Inspecting Officer of Railways. The other members of the Committee are:—Major Hall, Inspecting Officer of Railways; Mr. J. H. Thomas, M.P.; Sir Robert Turnbull, of the Railway Employment Safety Appliances Committee; Major E. Edmunds, Director of Signals, Ministry of Transport; Mr. W. C. Acfield, signalling superintendent, Midland Railway; Mr. G. E. C. Cox, superintendent of the line, South-Eastern and Chatham Railway, and Mr. N. Gresley, locomotive engineer, Great Northern Railway.

The Committee's terms of reference are:—To enumerate the possible functions of automatic train control in relation to railway conditions in the United Kingdom, and to prescribe the requisites which the devices should fulfil; to examine automatic train control devices under trial, and to recommend for further trial or for experimental installation any devices which are, or may become, valuable during investigation; and to form conclusions on the adoption of automatic train control in respect of all, or any, of its possible functions, having regard to the advantages which would be obtained and the cost involved.

A Radium "Substitute."—A "perfect" substitute for radium can be produced by means of a chemical process which purifies mesothorium, according to investigators at the Department of Chemistry, Missouri University, who are working in conjunction with the U.S. Bureau of Mines. Mesothorium is a by-product obtained in the manufacture of gas-lamp mantles, and is found in the monazite ore of Brazil. The radium substitute can be used "effectively" for medical purposes, it is claimed.

Educational.—POLYTECHNIC, REGENT STREET, W. 1.—ELECTRICAL ENGINEERING DEPARTMENT.—A special course of six lectures will be given on Friday evenings, commencing November 12th, at 7.45 p.m., by Mr. H. P. Young, A.M.I.E.E., on "Electricity Supply." The course will deal with the general arrangement of systems, operation of A.C. and D.C. generators, switchgear, sub-stations, transmission and distribution. Fee for the course, 7s. 6d. For further particulars see our advertisement pages to-day.

UNIVERSITY COLLEGE, North Wales, has acquired large disused mills at Bangor to establish a department in hydro-electrics—the first in the country. Mr. T. D. Owen, Wallasey, has contributed £10,000 to the scheme.—*Daily Chronicle*.

Failures of Large Turbo-Generators.—Writing in recent issue of *Power*, Mr. F. D. Newbury, the manager of the Westinghouse Co.'s power engineering department, gives a record of armature breakdowns which have occurred in units of 10,000 K.V.A. and above since the first one of this size was installed in 1915. Twenty-two cases are recorded, and these have been classified with some difficulty under various heads.

1. Eight cases were chargeable to design, workmanship, or other cause for which the manufacturer accepted responsibility.

(*a*) Five cases were caused by defects in manufacture that developed shortly after installation.

(*b*) Three cases concerned details of design that led to failure after four or five years' operation. Two of these cases (in one design) involved high local temperatures caused by eddy currents in the top strands of the coil.

2. Eleven cases were chargeable to operating hazards for which the operating company accepted the responsibility.

(*a*) Four cases were caused by fire originating outside of the armature winding. In three of these cases the fire started in the cables just outside of the generator; in the fourth case the fire started in a series transformer accidentally open-circuited.

(*b*) Four cases occurred in one installation and were caused by abnormal voltage surges that caused the outside surfaces of the insulation to catch fire. In addition to these four cases that resulted in coil failures, as many more fires started that were put out before such damage was done. This trouble disappeared after the generator neutral was grounded.

(*c*) One case was caused by ice or water carried into the generator from the air washer.

(*d*) Two cases were caused by enforced operation under conditions that were known to be unsafe. One case involved unsafe overloads and the other case involved continued operation after it was known that the armature needed minor repairs.

3. Three cases involved unknown causes or the cause was in dispute. In two of these cases the operating company believed armature-coil heating to be responsible.

This classification of armature breakdowns shows that out of 19 cases, where causes were agreed to, 11 cases were caused by operating hazards for which the generator can in no way be held accountable. The majority of these cases were caused by fires of external origin.

If all of the cases in which armature heating was involved (even by suspicion) are grouped, there are only five cases out of 22 breakdowns. Two cases (involving one of the first designs) were caused by design proportions; in two others temperature was not the primary cause of breakdown, but the operating companies believed it to be a contributory cause; and in the fifth case enforced overloading was the primary cause.

The writer's opinion, based on a careful study of operating experience and a detailed knowledge of internal temperatures and coil and insulation design, is that breakdowns caused by armature heating are in reality due to abnormal local temperatures that have values of the order of several hundred degrees; and that temperatures of 100 deg. or 150 deg. ordinarily discussed in connection with guarantees have very little to do with the problem. This statement, of course, applies only to windings completely insulated with mica within the slots.

The facts brought out by this record may be summarised as follows:—

1. The majority of armature breakdowns are caused by operating hazard originating outside the generator.

2. Armature heating in armatures completely insulated with mica is a minor cause of breakdown.

3. High-voltage generators, with mica insulation and open armature slots, are as reliable as and probably are more reliable than large, low-voltage generators.

Federated American Engineering Societies.—The Organising Conference of delegates representing some sixty engineering societies of the United States met in Washington, D.C., on June 3rd and 4th, 1920, and adopted the following resolutions:—

Resolved, That it is the sense of this conference that an organisation be created to further the public welfare where technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions and

Resolved, That it is the sense of the conference that the proper organisation should be an organisation of societies and affiliations and not of individuals.

The motive of the organisation is best shown by quoting from the opening address of Mr. Richard L. Humphrey, the spirit of which prevailed throughout the session: "I believe that the keynote of this conference could be properly expressed by the word 'service'; we desire, first, to serve the country, and second, to serve the societies and organisations of which we are the representatives. One cannot contemplate service, which means giving—not receiving—with any feeling that it is actuated by selfish motives, but rather is it the giving of our best. . . . I am supremely confident that a body of men of the high order of intelligence that is here represented cannot fail. I am confident that there will be laid at this conference the cornerstone of the united engineering and allied technical professions that will deal with public affairs of the city, state and nation, where engineering experience and technical knowledge are involved, and that will take action on other matters of a non-technical character which are of common concern."

The Conference adopted resolutions urging the payment of adequate salaries for the teachers of engineering in technical institutions in order that adequately trained young engineering talent may be made regularly available; and advocating the immediate adoption of appropriate measures to give effect to the recommendations made to Congress by the Commission which recently reported upon a more adequate salary schedule for the engineering and other technical services of the Federal Government.

The constitution and by-laws are still to be ratified by the societies expecting to become members, except for the A.S.M.E. and the A.I.E.E.

The Constitution provides for the establishment of a National Engineering Council composed of delegates elected by the constituent societies on the basis of membership; an Executive Board of 30 members, and an Executive Officer acting as secretary to the Board and the Council. The membership will consist of national, local, state, and regional engineering and allied by-laws are given in full in the *American Machinist* for August 21st, 1920.

Economical Supply of Electric Power in the U.S.A.—When Mr. W. S. Murray, consulting engineer, of New York City, came forward with his super-power scheme for the North Atlantic seaboard of the U.S.A., which we outlined in our issue of June 18th last, and by which it is claimed to be possible to eliminate the economic waste in the present power system, national interest was, says *Power*, immediately aroused, and the U.S. Government recognised the appeal made by a committee representing the engineers of the country which appeared before the Appropriations Committee of the House of Representatives in April last to present the case of the super-power scheme; both branches of Congress have now approved of a survey of the zone being made, and in its Sundry Civil Bill made provision for an amount of $125,000 with which to carry out the work. In order to carry out the investigation a Super-power Committee was formed, of which Mr. Murray was appointed chairman by the Secretary of the Interior. The organisation has been divided into three departments for investigation purposes, *i.e.*, (*a*) railways, (*b*) industries, and (*c*) power and transmission; the instant and favourable response to the 450 communications addressed to the Government and public service Commissioners, and to the executives of railways and power stations in the States which the proposed super-power zone will include, indicates a desire to help in every possible way. The part that the Government is playing in the matter is only to finance an administrative and engineering staff to show clearly what waste of power and materials exists to-day; the staff has been organised, and is known as the Super-power Survey, with headquarters at 709, Sixth Avenue, New York City. As the object of the investigation and report is necessarily divided into two principal sections: (*a*) allocation of, and the amount of waste in labour, fuel, and other materials as at present applied to the railways and industries in the zone, and (*b*) the design of a regional system by means of which the waste will be eliminated, it seemed of special importance that the investigation should be divided into three departments, as above stated. To that end three departments were created and a division chief appointed to head each, with an engineer-secretary to collaborate in the collection of field data. The services of the chief hydraulic engineer of the U.S. Geological Survey and of the chief mechanical engineer of the Bureau of Mines will also be contributed in part to the engineering staff of the Super-power Survey. It was desirable to obtain the counsel of men who would be representative of power producers and power consumers and of the people as a whole representing a national power policy. Therefore an advisory board was appointed of men representative of the above classes, and to that end the Secretary of the Interior officially invited to membership on such a board men who would be representative of New England railroads, New York railroads, engineering, technical publicity, the National Electric Light Association, the American Electric Railway Association, the American RailwayAssociation, and the National Industrial Conference Board. The report, with its maps and diagrams, is to be presented on June 30th, 1921, on which date the Congressional appropriation terminates, and the matter will then be in the hands of Congress and the Committee will be dissolved.

Wave Transmission.—At the annual meeting of Messrs. W. H. Dorman & Co., Ltd., the chairman, referring to the development of the wave transmission system by the company, stated that it should find a valuable application to coal-cutting machinery, in conjunction with electricity, the latter being used as the motive power at the top of the shaft, whence the power would be transmitted to the working face by the wave system, thus avoiding the use of electricity in the workings. He referred also to important developments in connection with the Hele-Shaw hydraulic clutch, for which the company had acquired the whole-world patent rights. This clutch is now made for powers up to 1,200 H.P. It was being used in connection with A.C. motors in the company's new works, and was expected to be of the greatest use to the electrical industry.

The Economic Selection of Coal.—A paper on the above subject, read at the autumn meeting of the Iron and Steel Institute at Cardiff, indicated how microscopic work, used in conjunction with chemical analysis, can be of great help in the most economical selection of the most suitable fuel for industrial purposes.

The method usually adopted, where any notice at all is taken of the coal, is to make a proximate analysis (at the best very unsatisfactory and really of little use), collate the results with practical experience, and make a trial on some particular plant. Only too often it proves to be unsatisfactory. The trouble arises from the fact that two coals can have practically the same appearance, give the same analysis, and yet be totally different in behaviour. This occurs very frequently, and does not seem to be realised by fuel users generally. It is obvious that some better method is necessary to enable suitable fuel to be selected.

To be in a position to select coal, an idea of its mode of formation is essential. Various theories have been brought forward from time to time, and though they have helped to account for some phase in the formation of coal, most of them have suffered from too limited a view of the subject. So far as this paper is concerned the coal in the principal British seams may broadly be taken as being composed somewhat as follows: At the bottom occur leaves, small stems, broken-down wood tissue, &c., from ferns, horsetails, and cordiates; and above the main bulk of the coal made up of the remains of *Lycopods*, which include the great *Lepidodendrons; Sigilarias*, &c., the spore-bearing trees, and above these again the "Cannels," which are a class apart. The coal falls into three main types: (*a*) "Humic," composed of leaves, stems, and broken down woody tissue, together with some spores; (*b*) "Spore" coals, in which both "Micro" and "Mega" spores predominate, and (*c*) "Cannel" coals. The spores are the reproductive organs of the plants and correspond with the pollen and ovules in present-day flowering plants. In some cases the two kinds were born in one cone, in others, in separate cones. The "Micro" spores are very small, while some of the "Mega" spores are about ¼ in. diameter.

It will be realised that these three classes run one into another, and this is where microscopic work is necessary to enable one to judge, from experience and comparison with other coals, what a particular sample can be used for.

It was the unsatisfactory nature of chemical classification which led to the microscope being used in selecting some 250,000 tons of coal per year for different purposes. It was soon seen that there were three main types, and that each type was suitable for certain classes of work. Further work along the same lines enabled one to judge how far from the typical member it was possible to go without getting into difficulties.

The microscopic observations are considered along with the chemical. To help one to decide whether or no a coal will be satisfactory, the following chemical analyses are required:—

1. A proximate analysis (an ultimate one is not really necessary, except for subsequent plant efficiency calculations).
2. The percentage of total sulphur.
3. The percentage of sulphur in the ash (necessary to get the amount of sulphur which will be carried away in the products).
4. An analysis of the ash itself (necessary to form some idea of the tendency to form clinker).

Coal from the same seam is generally very uniform. Sections cut from the same seam, but delivered on date 12 years apart, show that the coal is of the same type.

Shop Lighting.—A correspondent of the *Near East* recently made the following comments on this subject:—

A tour of the shops reveals astonishing differences in the use made of artificial light. The movement towards earlier closing may perhaps account for some of the indifference displayed to the subject of window lighting, but it is an open question whether it would not be advantageous to make any further restriction of shopping hours at the beginning rather than at the end of the day. Certainly the display made by shops after dusk is a powerful attraction, and brings business to many trades which, not catering for absolute necessities, must make their appeal to a large section of the public after working hours.

The poor results achieved in so many examples of shop lighting seem due rather to lack of advice than means. The medium generally employed, electricity, lends itself to any scheme, whether correct illumination or frank advertisement is sought, and in most cases the large stores and multiple shops show an appreciation of its possibilities which suggests that the work has been done by experts, but it is too often obvious that the very facilities offered by the electric lamp to the window dresser have only been taken advantage of to the abuse of the simplest principles of good lighting. Contracting firms which sell and fit electrical apparatus are much to blame for this state of affairs, and indeed sometimes show an inability to light their own windows correctly or seize the opportunity presented of showing their wares as they should be used by their customers.

Inspection of the best shopping thoroughfares of the West End of London reveals an almost entire absence of electrical window displays of any value, and none devoted to the interest of the retail shopkeeper. Those who wish to keep their installations up to date are expected to take the initiative, and, penetrating into more or less gloomy showrooms, to inquire for appliances of the existence of which they may be unaware. If successful in finding them they will possibly be asked to judge of their effect amongst a heterogeneous collection intended for every class of use to which electric lighting can be put. The same reproach may be made against the electrical traders with regard to fittings intended for the home. They are able to offer a variety of pieces of apparatus of attractive appearance and great usefulness, but few venture beyond a timid window display of unpriced goods, which, even if new and attractive, suggest to the uninitiated a discouraging rarity and expensiveness.

The electrical retail trade has not yet learned the first lessons in salesmanship; most of its shops present either a medley of apparatus mixed with cable and tubing, in which the user takes no interest, or else offers a prospect of brass-plated emptiness suggestive of the tailor who is so high class that his prices may not be known and his goods inspected only by those who will venture within.

The average electrical contractor has for so long been accustomed to send his clients to the manufacturers' or factors' showrooms to choose fittings that he has not awakened to the possibilities of a direct counter trade or realised how much business, both on apparatus and in wiring, awaits the electric shop which shows the passer-by attractive appliances in use, and so creates in his mind a desire which did not exist. The sale of electrical apparatus is so bound up with wiring alterations and extensions that it would be a pity were it to fall entirely into the hands of hardware retailers and house furnishers, who, however, may at any time become alive to its possibilities, and by businesslike window displays secure much trade to which the electrical firms are properly entitled.

A little examination of the "single purpose" displays made by leading firms in the photographic, office equipment, and certain other trades at once suggests possibilities for those who sell the more portable and attractive electrical appliances, such as kettles, flatirons, small cooking pots and pans. Given the courage to concentrate on a good stock of a few lines and to enlist the aid of the skilled window dresser, always with the proviso that figures of selling price and cost of operation at the local rate for electricity be marked plainly, then the electric shop may take its proper place amongst the features of our trading thoroughfares, and incidentally become a powerful business-getter for every branch of the industry.

South Africa's Telephone System.—The *British South African Export Gazette* recently commented as follows upon the Union's telephone system:—

"The allocation of £600,000 for telephone and telegraph extensions made by the Union Government in its loan estimates for the current year is a step in the right direction. The existing services have been subjected to much adverse criticism for some time past, and not only have belated renovations and renewals to be made, but the time has arrived when the authorities can no longer delay the promised installation of automatic telephone systems at Johannesburg, Capetown, and Pietermaritzburg. In these, British manufacturers have a particular interest, for last year, despite supply difficulties, they succeeded in regaining their position as the chief source of the Government's purchases temporarily occupied by Sweden during the war, and out of a total from all sources of £77,984 secured £59,443, as against Sweden's £8,855, and America's £9,686. There is little doubt that, should they make the effort, the greater part of the £600,000 mentioned above, and all that is to follow, will fall to them and to their agents in South Africa. The recommendations of the Government official who last year made a tour of the United Kingdom and America will be followed, and concerning telegraph working, the whole matter of the development of machine printing telegraph apparatus has been occupying the attention of the Department for some time past, and although we do not think the 'Creed' system now in use will be superseded, its extended use throughout the country is a certainty. With regard to telephonic communication, besides the three automatic exchanges mentioned above, the trunk line systems between the larger towns are to be increased and improved, and an effort made to induce farmers in the country districts to co-operate in the erection of rural telephone lines similar to the 'farmers' party lines' now almost universally used in America and Canada, which consist of ten or more subscribers being connected to one line, which in turn is connected to the switchboard of the nearest town. The commercial needs of South Africa, however, call for an even more active development policy than that briefly indicated above. Meanwhile over half a million is to be spent in various directions almost immediately, and as a start that should do much to remedy existing deficiencies. At the same time, attention might also be directed to the trade now being done outside the Government itself, which last year amounted to £16,727 worth of telegraph and telephone material being purchased on private account, and which is rapidly growing—a fact which is borne out by the imports for the first five months of the current year amounting to £11,043."

A Consulting Engineer!—Counsel at West London County Court recently to debtor: "You call yourself a consulting engineer. What is a consulting engineer?"

Debtor: "When I am out of employment I go to consult people for work."—*Evening News.*

Austrian-British Debts.—In the *Board of Trade Journal* for October 14th, particulars of the provisions for settlement of debts contained in a British memorandum dated August 27th were published. The conditions were accepted by the Austrian Government.

Electrically-hardened Taps. — Comparisons of taps hardened in electric and gas furnaces at the Frankford (Pa.) Arsenal, indicate, says the *Electrical World*, that superior physical qualities, as shown by longer life, are obtained with the electrical treatment. The electric furnace was, after brief instructions, operated by the same man who had hardened taps in the gas furnace for several years. The taps were used for tapping fuse holes in steel projectiles, and tests were made on taps from four different brands of steel. The following table represents the number of holes tapped after hardening, and the marked increase in the life of the electrically-treated taps is shown :—

	New.	First re-grind.	Second re-grind.	Third re-grind.	Total.	Increase in life %.
Brand A.						
Average (7) gas treated ...	29	204	86	65	384	—
Average (2) electrically treated	100	270	33	103	506	32
Brand B.						
Average (7) gas treated ...	84	151	25	36	296	—
Average (2) electrically treated	7	381	26	20	437	48
Brand C.						
Average (9) gas treated ...	94	210	207	9	520	—
Average (8) electrically treated	414	232	129	8	782	50
Brand D.						
Average (7) gas treated ...	131	243	340	71	792	—
Average (2) electrically treated	520	107	350	10	987	25

Except with brand B, the average is very marked before the first regrind. The fact that these taps averaged 384 holes after the first regrind indicates that the fault is not in the hardening, but in some unavoidable feature in the grinding, or in the use of the taps. The outer case of the taps should be the hardest, and if the tap is held to shape in hardening, more of its hard surface remains for use. This would probably be the case in the electric furnace and might account for the greater life before the first regrind. Then, again, there is more decarbonisation in the gas furnace, and this would cause the surface to be composed of low-carbon steel, which would not be good for cutting purposes. In the electric furnace the work is heated in a neutral atmosphere and emerges virtually as clean after hardening as before it was placed in the furnace, saving considerable time and money for finishing. The electrical treatment given the dies, which is patented by the Leeds and Northrup Co., Philadelphia, makes use of a recording thermocouple which indicates by a "hump" in the temperature curve that the critical point in the heating of the metal has been reached. The hump corresponds to a pause in the temperature rise, in spite of the fact that heat is being steadily transferred to the work. It is said to be an accurate means for determining the exact amount of heating that should be applied to the material under treatment.

Steel Industry in British Columbia.—The establishment of an iron and steel industry in British Columbia may be expected shortly. The Investigation Committee sent to Chicago by the British Columbian Government to report on the success of electrical furnaces there, has returned and reported favourably. The Committee will advocate first the establishment of an electric scrap mill in British Columbia to handle the large quantities of scrap iron and steel, now sent every month to Seattle mills.—*Reuter's Trade Service* (Vancouver).

The Coal Strike.—The coal miners' strike is ended, and work is to be resumed immediately. A majority of 8,459 votes was returned by the ballot against the settlement terms, but it was considered insufficient to warrant a continuance of the strike, as it fell short of two-thirds of the votes recorded. The main features of the terms on which the ballot was taken are : 2s. per week advance until the end of the year, and from Jan. 3rd a wages scale based on coal output until a national wages board is set up.

Eight-Hours' Day in Switzerland.—A measure in favour of an eight-hours' day for employés of the Swiss railway, postal, telegraph and telephone services has been carried on a referendum by a substantial majority ; 67 per cent. of the electors voted.

The Second Simplon Tunnel.—The Commercial Secretary to His Majesty's Legation at Berne reports to the Department of Overseas Trade that down to end of September, 18 250 km. (92 per cent.) of the second Simplon Tunnel had been pierced, out of a total length of 19·825 km. On the same date, 90·9 per cent. of the total length of the tunnel had been duly walled and wholly completed.

"Fashion foretells an Electrical Christmas."—We observe from E.D.A. advertising that a serious attempt is being made to cultivate the great trade possibilities offered by the season of "Present-giving" in connection with electrical appliances.

If Supply Engineers and Contractors will, for once, make a united effort to push the Electrical Xmas Box idea they are not likely to be disappointed in the immediate results, or in the new connections and goodwill they may establish in helping people to keep up a social custom which, delightful as it may be, is often a cause of anxious thought and too frequently results in money being spent on articles of but transient attraction and little real value.

Appointments Vacant.—Assistant constructional engineer (£570), for the City of Birmingham Electric Supply Department ; overhead linesman (£5), for the County Borough of Burnley Tramways Department ; cable-jointer, for the Eccles Corporation Electricity Department ; switchboard attendant (84s.), for the Nuneaton Corporation Electricity Department ; assistant electrical engineer (£480), for the Gold Coast Government. See our advertisement pages to-day.

Trade with Canada.—At the Canadian National Exhibition held in Toronto recently, which was attended by over a million visitors, only 30 British firms were represented out of a total of 672 exhibitors. At the Bureau of Information of the Department of Overseas Trade, many inquiries were received regarding British export trade, one of the principal being : "When do United Kingdom firms propose to take more serious steps to cater for the Canadian market ?"

INSTITUTION NOTES.

Midland Junior Gas Association.—The new president of the Association is Mr. W. J. Pickering, superintendent of the Coal Test Works, Birmingham Gas Department, and in his presidential address on Thursday last week at the Council House, asked : "What of the future with regard to our relations with the Electrical Industry ?" The special adaptability of electrical plant for certain industrial power purposes was conceded as readily as anyone by the present day gas engineer and the amount of such plant in modern gas works tended to increase. Each of the industries had its particular field, and both realised that. Whatever changes the future might bring, the practice of "burning" raw coal, for any purpose, rather than "distilling" it, should be abandoned at the earliest possible moment, as the value of the numerous by-products from coal would tend to increase. Developments might be seen as regarded the conversion of gas into electrical energy. Some form of gas turbine might be evolved which would revolutionise present methods and bring down the price of the electrical unit. Whatever happened, they and their electrical friends had to bear in mind that, as great public servants, it would always be their duty to proceed on lines which would confer the greatest benefit on the community. It was not likely that either industry would be entirely superseded by the other, but rather that the two would work quite harmoniously, in their respective fields, though the latter might become more sharply defined.

Institution of Electrical Engineers.—A special general meeting has been convened for December 2nd, at the Institution of Civil Engineers, to consider, and, if thought fit, to pass a resolution to take the place of Article 27 of the Institution's Articles of Association. The substance of the resolution is that subscriptions shall, from January 1st next, be increased as follows :—

	United Kingdom.	Abroad.
Members	£5 5 0	£4 5 0
Associate Members ...	3 15 0	3 5 0
Associates	4 5 0	3 15 0
Graduates	2 10 0	2 10 0
Students (under 21) ...	1 1 0	1 1 0
" (over 21) ...	1 11 6	1 11 6

Should this resolution be passed, it will be submitted to a meeting of Corporate Members on December 17th for confirmation.

WESTERN CENTRE.—The first ordinary general meeting of this session will be held at the Merchant Venturers' Technical College, Bristol, on Monday, November 8th, when the inaugural address will be delivered by the chairman, Mr. A. J. Newman.

NORTH-EASTERN CENTRE.—The first meeting of the session 1920-21 will be held on November 8th, 1920, at the Armstrong College, Newcastle-on-Tyne when the chairman-elect, Mr. J. R. Beard, will deliver his inaugural address.

Warrington Electrical Society.—"Alternating-current Switchgear" was the subject of a lecture delivered by Mr. Parker, of Messrs. Long & Crawford, of Manchester, at the last meeting of the Society. In the course of his lecture, Mr. Parker dealt with all kinds of starting apparatus, both for squirrel-cage and slip-ring machines, and made detailed references to overload coils, no-volt releases, fool-proof gear, and the uses of time lags. Mr. F. V. L. Mathias, Warrington Corporation electrical engineer, presided.

The Royal Society.—Amongst the papers to be read on Thursday, November 4th, were the following :—

Prof. H. Lamb, F.R.S., "On the Vibrations of an Elastic Plate in Contact with Water."

Prof. H. M. Macdonald, F.R.S., "The Transmission of Electric Waves Around the Earth's Surface."

King's College, London : Old Students' Association (Engineering Faculty).—A luncheon was held at the Holborn Restaurant on October 27th, when 54 members attended, and many distinguished "King's" engineers were present, among whom were the chairman, Mr. C. H. Wordingham, C.B.E., a past president of the Institution of Electrical Engineers ; Mr. Ll. B. Atkinson, president of the Institution of Electrical Engineers ; General M. Mowat, C.B.E., secretary of the Institution of Mechanical Engineers ; Mr. E. Fiander Etchells, president of the Concrete Institute ; and Mr. J. S. Highfield. Any old students who are interested in the activities of the K.C.L.O.S.A. are requested to communicate with the hon. assistant secretary, Mr. D. H. Kendon, King's College, Strand, W.C.2.

Association of Engineers-in-Charge.—On Friday, November 12th, a Ladies' Night will be held in the Crown Room of the Holborn Restaurant. Applications should be addressed to the hon. secretary, Mr. A. E. Penn, 2, Bassingham Road, Earlsfield, S.W.18.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. E. L. EASTGATE, A.M.I.E.E., lately engineer at the Melbourne branch of the British General Electric Co., Ltd., has been appointed manager of the company's business in New Zealand owing to the resignation of Mr. J. H. Ryder, A.M.I.E.E.

Messrs. J. J. STANDRIN and H. HOLMES, apprentices at the Hydro-electric Department, Tasmania, and who have completed two years' mechanical training, have been selected to go to England and America for two years to complete their term of five years. Both apprentices are to spend a year at the British Thomson-Houston Co., Rugby, and a similar period at the General Electric Co., Schenectady, U.S.A., returning to the Hydro-electric Department on completing their overseas course.—*Commonwealth Engineer.*

Mr. W. A. A. BURGESS, M.I.E.E., late resident electrical engineer for the British Dyestuffs Corporation, Huddersfield, Ltd., has been appointed chief electrical engineer for the British Dyestuffs Corporation, Ltd., with charge of the electrical equipment at all the Corporation's factories. Mr. Burgess, whose headquarters remain for the moment in Huddersfield, has had charge of the electrical department of the Corporation there for the past five years, and was for nine years previously with Messrs. Merz & McLellan.

Mr. W. F. INGAMELLS, who has resigned his appointment as advertising manager with the Edison Swan Electric Co., Ltd., was on Friday last week presented with a diamond and pearl scarf pin by the general staff at the Ponders End works of the company. The presentation was made by Mr. H. V. Richards, chief assistant in the advertising department, the gift being accompanied by a tastefully printed address, with the list of subscribers. At the same time Mr. Ingamells was presented with a silver card case by Mr. J. Thom, on behalf of the staff of the stationery department.

Mr. J. H. BUTTERS, chief engineer and general manager of the Tasmanian Hydro-electric Department, is paying a visit to this country. His address during his stay will be c/o The Agent-General for Tasmania, Australia House, Kingsway, W.C. 2.

Mr. R. W. GRUBB, temporary electrical engineer to the Dewsbury Corporation, has been appointed permanently to the position at a salary of £650 per annum.

Chester T.C. has increased the salary of the electrical engineer to £900 a year, including £150 additional war bonus.

Sir ERNEST JARDINE, Bart., governing director of John Jardine, Ltd., has received information from the French Minister of Commerce that the honour of the Croix de Chevalier de l'Ordre National de la Légion d'Honneur has been conferred upon him by the President of the French Republic.

Mr. G. C. ALLINGHAM, M.B.E., M.I.E.E., who was until recently chief engineer of the Tudor Accumulator Co., Ltd., has joined the staff of Mr. C. F. Elwell, radio engineer, Craven House, Kingsway.

Mr. W. E. HIGHFIELD has resigned his position with the English Electric Co., Ltd., to enter into partnership with his brother, Mr. J. S. Highfield, consulting engineer, at 36, Victoria Street, Westminster.

At Messrs. Simplex Conduits, Ltd., on Friday last week, a presentation of books was made to Mr. T. BIRKETT upon his resigning the position of publicity manager to the company, and at the same time the chairmanship of the Welfare Club. Capt. McLoughlin, joint general manager, in making the presentation, said that not only would Mr. Birkett be missed by the firm, for the publicity work for which he was responsible was of a distinctive order, but he would also be missed by all of the employés by reason of his work on the Welfare Club. Mr. Birkett is taking up the position of sales and publicity manager to the Midland Electric Manufacturing Co., of Barford Street, Birmingham.

NEW COMPANIES REGISTERED.

Dungarvan Electric Light & Power Co., Ltd. (5,059).—Registered in Dublin October 18th. Capital, £8,000 in £1 shares. Objects as title. First directors: T. Power, 18, O'Connell Street, Dungarvan; T. Foley, The Square, Dungarvan; M. Barry, Abbeyview, Dungarvan; M. Clancy, Main Street, Dungarvan; D. Crotty, Dungarvan; J. Dunne, Dungarvan; P. J. Moloney, Dungarvan. Secretary: E. A. Ryan. Registered office: Castle Street, Dungarvan.

Evans (Electrical), Ltd. (171,083).—Private company. Registered October 28th. Capital, £5,000 in £1 shares. To carry on the business of electricians, electrical engineers and manufacturers, suppliers of electricity, &c., and to adopt an agreement with E. J. Walker. The first directors are: E. J. Walker, Southbank, Ravensbourne Road, Bromley, Kent; S. L. Durell (managing director), 2, Edward VII Mansions, Chamberlayne New Road, Kensal Rise, N.W. Registered office: 10, Bush Lane, Cannon Street, E.C. 4.

Lowth & Smith, Ltd. (170,977).—Private company. Registered October 22nd. Capital, £5,000 in £10 shares. To take over the business carried on at 3, Hanging Ditch, Manchester, as "Lowth and Smith," and to carry on the business of electrical and mechanical engineers, &c. The permanent directors are:—W. H. Lowth, 13, Lynton Road, Chorlton-cum-Hardy, Manchester; T. Smith, 5, Wood Bank, Helmshore, Lancs. Registered office: 3, Hanging Ditch, Manchester.

British Electrical & Allied Industries Research Association (the word "limited" is omitted from the title by licence of the Board of Trade) (170,454).—Registered September 27th (delayed at Somerset House). The company is limited by guarantee, with an initial membership of 300, with power to increase. In the event of winding up, each member is liable for not more than £5. Objects: To promote research and other scientific work in connection with the electrical and allied trades or industries, to found scholarships, to publish books and periodicals, &c. Membership of the Association consists of (a) ordinary members, who shall be members of the British Electrical and Allied Manufacturers' Association or other association of manufacturers in the electrical and allied industries carrying on business in the production of electrical machinery, apparatus, commodities, or requirements, (b) trade members who shall be British subjects carrying on business in the production of electrical machinery, apparatus, or materials which are accessory to the electrical and allied manufacturing industries, and corporations carrying on similar business, (c) Associate Members who must be British subjects and shall be individuals representative of capital, management, science, or skilled labour, or connected with limited companies, or other corporations or associations ineligible for, or not desiring admission as ordinary or trade members, and who are, in the opinion of the Council, likely to assist in the electrical and allied industries by the furtherance of the objects of the Association, and (d) Honorary members, who shall be British subjects, whether entitled to become members under the above provisions or not, nominated for membership by the Council for special services or causes and elected at a general meeting. The management is vested in a Council, the first members of which are: C. H. Wordingham, C.B.E., 7, Victoria Street, Westminster; L. B. Atkinson, Alston, Little Hampden, Great Missenden, Bucks.; Dr. C. C. Garrard, General Electric Co., Ltd., Witton, Birmingham; J. S. Highfield, 36, Victoria Street, S.W.1; C. C. Paterson, O.B.E., Research Laboratories of the General Electric Co., Ltd., 67, Queen Victoria Street, E.C.; R. T. Smith, 66, Porchester Road, Paddington (president, Institution of Electrical Engineers); C. P. Sparks, Blackfriars House, New Bridge Street, E.C.; D. N. Dunlop, 36, Kingsway, W.C.; A. R. Everest, British Thomson-Houston Co., Ltd., Rugby; A. P. M. Fleming, C.B.E., Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester; E. S. New, 11, Victoria Street, S.W.; W. O. Smith, Century Works, Lewisham; E. B. Vignoles, Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick; A. D. Williamson, Vickers, Ltd., River Don Works, Sheffield. Solicitor: T. Trimmell, 71, Lincoln's Inn Fields, W.C. Registered office: 19, Tothill Street, Westminster, S.W. 1.

Westinghouse Brake Subsidiaries, Ltd. (171,046).—Registered October 26th by Linklater & Paines, 2, Bond Court, Walbrook, E.C. Capital, £40,000 in £1 shares. To acquire certain assets belonging to the Westinghouse Brake Co., Ltd., to carry on the business of manufacturers of railway brakes and rolling stock for railways, and appliances for lighting railway and other carriages, &c. The first directors are:—J. W. Cloud Claridges Hotel, W.1 (managing director, Westinghouse Brake Co., Ltd.; director, Clyde Valley Electrical Power Co., Ltd., Compagnie Intl. pour le Chauffage des Chemin de fer Systeme Heintz, Ltd., Mackenzie Holland and Westinghouse Power Signal Co., Ltd., and Westinghouse Maise Chain Co., Ltd.); Lord Southborough, 17, Airlie Gardens, W.8 (director, Alby United Carbide Factories, Ltd., Anglo-Persian Oil Co., Ltd., Chinese Engineering and Mining Co., Ltd., Nitrogen Fertilizers, Ltd., Pacific Phosphate Co., Ltd. (deputy chairman), Sir W. G. Armstrong, Whitworth & Co., Ltd., Underground Electric Railway Co. of London, Ltd., and Westinghouse Brake Co., Ltd.); Lieut.-Col. M. Craddock, 90, Piccadilly, W.1 (director, Metropolitan-Vickers Electrical Co., Ltd., and Westinghouse Brake Co., Ltd.); J. H. Luke, 154, Ashley Gardens, S.W.1 (director, Clay's Marine Steering Gear, Ltd., and Westinghouse Brake Co., Ltd.). Minimum cash subscription, seven shares. Remuneration, £800 per annum, divisible. Solicitor: R. B. Phillpotts, 2, Bond Court, Walbrook, E.C.

Fairless Electric Weldings, Ltd. (171,010).—Private company. Registered October 25th. Capital, £10,000 in £1 shares. To carry on the business of electric, oxygen and acetylene welders, ship repairers, mechanical and electrical engineers, machinery manufacturers, tool makers, &c. The first directors are:—G. P. Fairless, Summerhill, Raby Road, Stockton-on-Tees, engineer; C. Henson, 47, Station Road, Stockton-on-Tees, engineer. Secretary: G. P. Fairless. Solicitor: A. H. Parkin, 77, High Street, Stockton-on-Tees.

A. L. Brown & Co., Ltd. (171,050).—Private company. Registered October 28th. Capital, £2,000 in £1 shares. To take over the business of electricians carried on by A. L. Brown and H. F. Mitchell at The Street, Frensham, Surrey, as "A. L. Brown & Co." The first directors are:—A. L. Brown, The Street, Frensham, Surrey; H. F. Mitchell, Millbridge, Frensham, Surrey. Registered office: Millbridge, Frensham, Surrey.

Saitax Manufacturing Co., Ltd. (171,071).—Private company. Registered October 2nd. Capital, £3,000 in 2,500 "A" shares of £1 each and 10,000 "B" shares of 1s. each. To carry on the business of electrical, mechanical, sanitary, gas, hydraulic, water and general engineers, manufacturers of machinery, particularly steam engines, electrical apparatus, theatrical and general stage effects, scenery, fans, lamps, rheostats, &c. The first directors are:—W. Adams, Henddol House, London Road, Thornton Heath; Capt. F. J. H. B. Hutchinson, 133, Westbourne Terrace, W. Registered office: 106, Albany Street, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London and Suburban Traction Co., Ltd.—Deed dated October 13th, 1920 (supplemental to trust deed dated April 6th, 1914, securing £350,000 5 per cent. "A" debenture stock), charged on 70,633 fully £1 preference and 2,193,330 fully paid ordinary shares in London United Tramways, Ltd., in substitution for 120,115 fully paid 5 per cent. cumulative preference shares of £10 each and 97,740 fully paid ordinary shares in the said company. Trustees: Union Commercial Investment Co., Ltd.

Burners, Ltd.—Issue on October 14th, 1920, of £250 debentures, part of a series already registered.

Portable Electric Motors (1919), Ltd.—Particulars of £10,000 debentures authorised October 21st, 1920, whole amount issued. Charged on the company's undertaking and property, present and future, including uncalled capital.

North British Tower Manufacturing Co., Ltd.—Particulars of £5,000 debentures authorised October 15th, 1920, whole amount issued. Charged on the company's undertaking and property, present and future, including uncalled capital.

Cambridge Electric Supply Co., Ltd.—Issue on October 18th, 1920, of £2,950 debentures, part of a series already registered.

Kalgoorlie Electric Tramways, Ltd. (73,127).—Return dated September 15th, 1920. Capital, £250,000 in £1 shares. All shares taken up. £250,000 paid. Mortgages and charges, £145,920.

CITY NOTES.

German Companies.

The Garbe, Lahmeyer Co., of Aix-la-Chapelle, reports net profits of 1,697,000 marks for 1919-20, as compared with 853,000 marks in the previous year. A dividend at the rate of 8 per cent. has been declared, as against 6 per cent. in 1918-19.

The directors of *Max Schorch & Co., of Rheydt*, recommend the payment of a dividend at the rate of 10 per cent. on share capital of 10,500,000 marks for 1919-20, this result comparing with 10 per cent. on 7,975,000 marks in the preceding year.

The Rheinisch-Westfalische Elektricitats Werk A.G., of Essen, after writing off 30,360,000 marks for depreciation in 1919-20, as contrasted with 6,810,000 marks in the previous year, reports net profits of 4,838,000 marks and 4,670,000 marks in the two years respectively, and a dividend at the rate of 8 per cent., as in 1918-19. The report states that the sales reached 687,989,000 KW.-hours, as against 626,361,000 KW.-hours in the preceding year.

The accounts of the *Kabelwerk Rheydt A.G., of Rheydt*, including the balance of 55,000 marks brought forward, show a net profit of 8,705,000 marks for 1919-20, as compared with 957,000 marks in the preceding year, and the dividend is at the rate of 40 per cent., as against 30 per cent. in 1918-19. The report states that the plant has been completely written off, and a falling off in orders has taken place since the beginning of the new financial year. It is proposed to increase the share capital from 10,000,000 to 24,000,000 marks.

Amalgamated Wireless (Australasia), Ltd.—At the annual meeting held in Sydney recently, Sir T. Hughes, the chairman, in moving the adoption of the report, outlined a scheme already placed before the Government for connecting up Australia with England consisting broadly of a high power, high speed, duplex-operated station near one of the capital cities to communicate with a corresponding station in England, together with medium power feeder stations near each of the other capital cities to pass the traffic to and from the main trunk stations. The company offered to handle all classes of messages at one-third less than existing rates, and to give the Commonwealth Government 25 per cent. of its net profits, also to have the stations working in two years, to hand them over in any time of national danger, to hand them over to the Government, free of all payment, at the end of a term of years, and to give the Government the right of resumption at all times.

Marconi Wireless Telegraph Co. of Canada, Ltd.—A special general meeting of the shareholders is to be held at the offices of the company in Montreal on November 23rd, for the consideration and approval of the by-law passed by the directors of the company on October 19th, 1920.

"Be it enacted as a by-law of the Marconi Wireless Telegraph Co. of Canada, Ltd., and it is hereby enacted as follows:—

"1. The by-law known as by-law No. 26 of the company, providing for the reduction of the capital stock of the company to 3,750,000 dollars, and ratified, confirmed, and enacted at the annual and special general meeting of the shareholders of the company, held on September 17th, 1919, is hereby again enacted and confirmed as of the said date.

"2. The capital stock of the company is hereby increased from 3,750,000 dollars to 7,500,000 dollars by the addition of 1,500,000 shares of the par value of 2 dollars and 50 cents each."

A Belgian Investment Co.—The report of the Compagnie Centrale de l'Industrie Electrique states that most of the companies in which the company is interested are still unable to determine their actual position, and the portfolio has been greatly reduced. In association with friendly groups the company has carried out the reorganisation of the Forges et Laminoirs Saint-Victor and the Société des Forges de Crêvecoeur, and the company has disposed of its participation in the tramways in the province of Salerno to an Italian group. The net profits for 1919-20 are 50,240 fr.; no dividend is to be paid.

A German Supply Company's Loan.—The directors of the Rhenish Electricity Works Co., of Cologne, require a considerable amount of new capital to defray the cost of extensions, as the plant has reached the limit of its productive capacity. It is proposed to increase the present ordinary share capital of 8,000,000 marks by an amount not yet determined, and at the same time raise a loan of 100,000,000 marks in instalments. The new generators alone are estimated to involve an expenditure of 60,000,000 marks.

Automatic Telephones (Australasia), Ltd.—Dividend of 1s. per share, absorbing £3,125, leaving a balance at June 31st of £1,137. A contract has been secured for an automatic exchange at Collingwood, Victoria, amounting to nearly £85,000.

City of Buenos Ayres Tramways (1914), Ltd.—Dividend at the rate of 5 per cent. per annum, less tax, for three months ended September 30th.

Calcutta Electric Supply Corporation.—Interim dividend at the rate of 8 per cent. per annum, less tax, on the ordinary shares for the half-year.

Monte Video Telephone Co., Ltd.—The accounts for the year ended July 31st show that after providing for all charges in Monte Video and London and for income tax and excess profits duty and corporation profits tax, the net profit amounts to £40,179. Interim dividend paid in May absorbed £6,514. £8,963 was brought forward and the available balance is £42,629. £20,000 is transferred to the reserve fund, and a final dividend for the year ended July 31st is recommended of 5 per cent., free of tax (making 8 per cent. for the year), leaving a balance of £11,772 to be carried forward.

Bombay Electric Supply & Tramways Co., Ltd.—At a meeting on Monday of the holders of the 4½ per cent. debenture stock of the Bombay Electric Supply Co. (in liquidation), a resolution modifying the rights of the holders against the company, its trust deed, and its property, and certain modifications of the trust deed which had been proposed by the company and recommended by the trustees, were agreed to. A meeting of the 5 per cent. second mortgage debenture-holders called for a similar purpose was adjourned for a week owing to the necessary amount of stock not being represented.

International Light & Power Co., Ltd.—For the year ended June 30th, 1920, the income amounted to £66,064 plus £13,877; after providing for debenture interest, sinking fund, loan and other charges there remains a balance of £35,420. Preference dividend amounts to £14,973, £2,500 is placed to reserve, and the balance (£17,947) is to be carried forward. Reserves of subsidiaries have been increased during the year by £6,503, making total reserves of three subsidiaries £74,487.

Austrian Brown-Boveri Works.—The net profits of the Austrian Brown-Boveri Werke A.G., of Vienna, amount to 2,581,000 crowns for 1919-20, as compared with 1,376,000 crowns in the preceding year, and the dividend is at the rate of 9 per cent., as against 7 per cent. in 1918-19. It has been decided to increase the share capital from 8,500,000 to 25,000,000 crowns.

Smit's Transformer Works.—An issue of 500 shares of 1,000 florins is being made by the N. V. Willem Smit & Co.'s Transformatoren Fabriek, of Nijmegan, Holland. The rate of dividend paid by the company for 1919-20 was 12 per cent. on share capital of 500,000 fl., as compared with 10 per cent. on 240,000 fl. in the previous year.

STOCKS AND SHARES.

Tuesday Evening.

The present week of the Stock Exchange consists of four days, owing to the November 1 holiday and the usual Saturday "recess." So it may almost be said that members of the House are beginning to approximate a miner's week, although the pay may not be as liberal. Business is far from being brisk. There was a fair accumulation of small orders awaiting execution on Tuesday morning, but after this was dealt with, the markets became quiet. Manifest disinclination to deal on the part of the general public was put down to the uncertainty in regard to the outcome of the third coal ballot. Little doubt, if any, was felt as to the majority vote going in favour of peace, but the attitude of the Welsh and Lancashire miners aroused uneasiness for the future. This, on top of the somewhat temporary character of the whole plan, restrains any sort of speculative enterprise.

The cable group is conspicuously good. There are rises in Eastern ordinary, Globe ordinary, Great Northerns, and Indo-European. Gossip concerns itself with the possibility of the income tax being raised next spring, and when there is any suggestion of income tax talk in the air, attention begins to turn to the stocks and shares of companies that pay their dividends free of tax. The Eastern group is, of course, particularly well known in this connection, and seeing that its ordinary stocks and shares, even at the current levels, offer nearly 6¾ per cent. on the money, it is not surprising that some people should look for a steady appreciation in value of these securities. Direct United States stick at 5½, from which it is inferred that profit-takers are not yet out. Marconis were run up to 3½, on buying said to be on behalf of a group in which American interests were strongly represented, but as soon as the purchases ceased, the price went back again to 2 15/16, at which it shows a rise of 1/16 on the week. Marconi Marines are easier at 17/16, and Cuba Submarines have fallen to 6½, following upon their sharp drop of last week. United River Plates at 6¾ have recovered the dividend. Amongst the manufacturing shares, Siemens hardened to 25s., and Henley's are better at 1 11/16, India Rubbers at 1¼ being similarly higher. Western Union 4½ per cent. funding bonds at 109½ are 2 points to the good.

Rio Tramways fives advanced to 96 and Electric Development of Ontario fives to 116. On the other hand, Canadian General Electric common at 119 and the preferred at 112 are both lower. Bombay Electric Trams have fallen 15 points to 50, and the preference at 11 were £1 lower. The market in these for some time past has been rather artificial, as we have pointed out here from time to time. Mexicans are

heavy, with falls in Mexican Light and Power preference and Mexico Tramways 5 per cent. bonds. While the news from Mexico is declared to be good, sellers continue to get out of their bonds quietly. British Columbia Electrics maintain their robust tone, and further rises have occurred in the preference and the deferred stocks. Anglo-Argentine Tramways 5 per cent. debenture has once more got over 60, being bought by those who regard it as a sound investment stock of the second class.

The Home Railway division is firm as a whole, on the expectation that the miners will accept the peace proposals. Metropolitan consolidated has recovered a point to 21¼. The company's 3½ per cent. debenture stock is better at 53½, and London Electric Railways 4 per cent. debenture has risen to 56¼. Underground Electric Railways issues are quiet, with ⅛ reaction in the £10 shares to 2½.

A few of the Home Electricity shares are wanted, and the market begins to look a little firmer than it has done. Westminsters are better at 5½. Men in the market point out that there is a decided shortage of supply, and that, were demand to arise, prices would not remain for long at the present figures. But it must be admitted that the inquiry for electric lighting shares is still very retail and somewhat timid.

Edisons have dropped to 17s.; Electric Constructions are better at 18s. 9d. Metropolitan-Vickers preference fell back to 40s., at which the yield is 8 per cent. on the money. Babcock & Wilcox continue to improve, and are now up to 50s. again. Rubber shares are weak on another low record being established for the raw material, which this Tuesday night is quoted at 1s. 2½d. per lb. The Armament market is better, moving quietly upwards with shares in the iron and steel list. But the Stock Exchange is quiet as a whole, and in none of the markets are there any financial fireworks to compel attention from the public.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Nov. 2, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6	—	£10 0 0
Charing Cross Ordinary	4	7	9½	—	10 15 6
do. do. do. 4½ Pref.	4½	4½	9½	—	8 5 8
Chelsea	3	4	9⅞	—	7 5 6
City of London	8	10	14	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	8	7¾	—	10 17 6
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 8
Kensington Ordinary	6	7	8¾	—	9 0 6
London Electric	Nil	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	8	—	10 0 0
Metropolitan	5	5	9¾	—	10 5 8
do. 4½ per cent. Pref.	4½	4½	3½	—	8 0 0
St. James' and Pall Mall	10	12	6¾	—	9 4 8
South London	5	6	2¾	—	9 12 0
South Metropolitan Pref.	7	7	16 8	—	8 12 6
Westminster Ordinary	8	10	5½	+ ⅛	9 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	77½ xd	+1¼	7 14 10
do. Def.	22/6	1½	17	— ½	8 16 6
Chile Telephone	5	6	6½	—	*5 9 1
Cuba Sub. Ord.	7	7	6¾	— ¼	*11 4 0
Eastern Extension	8	10	14⅝	—	*8 15 7
Eastern Tel. Ord.	8	10	149½	+2	*6 13 9
Globe Tel. and T. Ord.	8	10	14½	+ ½	*6 15 7
do. do. Pref.	6	6	8¾	—	7 1 2
Great Northern Tel.	22	22	20½	+ ¼	10 14 8
Indo-European	15	10	80 xd	+ ½	8 6 8
Marconi	25	25	2⅛	+ 1/16	8 10 0
Oriental Telephone Ord.	10	12	2¾	—	*4 18 4
United R. Plate Tel.	8	8	6¾ xd	+ ¼	*6 10 8
West India and Panama	1/6	Nil	¼	—	Nil
Western Telegraph	8	10	15	+ ½	*5 18 4
Home Rails.					
Central London Ord. Assented	4	4	43½	—	9 4 0
Metropolitan	1	1½	21½	+1	5 16 8
do. District	Nil	Nil	18	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	— ⅛	Nil
do. do. "A"	Nil	Nil	7/6	—	Nil
do. do. Income	5	4	70½	—	—
Foreign Trams, &c.					
Anglo-Arg. Trams First Pref.	Nil	5½	8	—	9 3 4
do. do. 2nd Pref.	Nil	Nil	8½	—	Nil
do. do. 5 Deb.	5	5	60½	+1	8 5 4
Brazil Tractions	Nil	Nil	44	—	Nil
Bombay Electric Pref.	6	6	11	— 1½	4 16 6
British Columbia Elec. Ry. Ptcs.	5	5	86	+2	8 18 6
do. do. Preferrred	5½	5	85½	—	*6 7 8
do. do. Deferred	Nil	5	86½	+1	*6 4 0
do. do. Deb.	4½	4½	63½	—	7 19 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	41	— 1½	Nil
do. 6 per cent. Bonds	Nil	Nil	22	—	Nil
Mexican Light Common	Nil	Nil	15	—	Nil
do. Pref.	Nil	Nil	26½	— 1	Nil
do. 1st Bonds	Nil	Nil	51½	—	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	2¾	+ ¼	*5 0 0
British Aluminium Ord.	10	10	1	—	10 0 0
British Insulated Ord.	12½	15	13	—	9 4 8
Callenders	25	15	1½	+ 1/16	10 0 0
" 6½ Pref.	6½	6½	18/9	—	6 18 8
Castner-Kellner	20	17	3	—	5 13 4
Crompton Ord.	10	10	17/6	—	11 8 6
Edison-Swan, "A"	10	10	17/-	—1/-	11 15 4
do. do. 8 per cent. Deb.	8	8	75½	—	8 12 6
Electric Construction	10	10	18/9	+6d.	10 13 4
Gen. Elec. Pref.	6½	6½	18/6	—	7 0 5
do. Ord.	10	10	1 1/16	—	*7 13 4
Henley	25	15	1 1/16	+ 1/16	9 4 8
do. 4½ Pref.	4½	4½	8½	—	7 4 0
India-Rubber	10	10	1½	+ 1/16	*8 0 0
Met.-Vickers Pref.	—	8	2	— ¼	8 0 0
Siemens Ord.	10	10	25/-	+6d.	*8 0 0
Telegraph Con.	30	30	20	—	6 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, November 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	2/5	...
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	"	£92	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£41	...
a Copper Sulphate	"	£42	...
a Potash, Chlorate	per lb.	1/-	...
a " Perchlorate	"	1/8	...
a Shellac	per cwt.	£32 10s.	...
a Sulphate of Magnesia	per ton	£18	...
a Sulphur, Sublimed Flowers	"	£25	...
a " Lump	"	£22	...
a Soda, Chlorate	per lb.	6d.	...
a " Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £800	...
c Brass (rolled metal 9" to 12" basis)	per lb.	1/5½	½d. dec.
c " Tubes (solid drawn)	"	1/6½ to 1/6¾	½d. dec.
c " Wire, basis	"	1/3¾	½d. dec.
c Copper Tubes (solid drawn)	"	1/7½	½d. dec.
c " Bars (best selected)	per ton	£149	£8 dec.
c " Sheet	"	£149	£8 dec.
c " Rod	"	£149	£8 dec.
d " (Electrolytic) Bars	"	£99	£15 dec.
d " " Sheets	"	£143	£15 dec.
d " " Wire Rods	"	£115	£15 dec.
d " " H.C. Wire	per lb.	1/2½	1½d. dec.
f Ebonite Rod	"	3/6	...
f " Sheet	"	3/-	...
n German Silver Wire	"	3/-	...
h Gutta-percha, fine	"	14/- to 16/-	...
h India-rubber, Para fine	"	1/0½	½d. dec.
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l " Wire, galv. No. 8, P.O. qual.	"	£29	...
g Lead, English Pig	"	£37 5s.	5/- inc.
g Mercury	per bot.	£15 12s. to £16	10/- inc.
c Mica (in original cases) small	per lb.	6d. to 4/6	...
e " " " medium	"	5/- to 10/-	...
e " " " large	"	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings	"	1/6 to 1/11	...
p " " rolled bars and rods	"	2/5 to 3/6	...
p " " rolled strip & sheet	"	2/5 to 3/9	...
d Silicium Bronze Wire	per lb.	1/11	1d. dec.
r Steel, Magnet, in bars	"	1/6	...
n Tin, Block (English)	per ton	£280	£11 inc.
n " Wire, Nos. 1 to 16	per lb.	4/9	...
p White Anti-friction Metals	per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p ———
r W. F. Dennis & Co.

Electricians' Mates' Wages.—We have received from Mr. W. J. Webb, London District secretary of the E.T.U., a copy of the memorandum of agreement come to on October 29th, 1920, between the London District Committee of the Electrical Trades Union and the National Federated Electrical Association, with regard to increase of wages for electricians' mates, electrical and mechanical fitters' mates, electrical wiremen's mates, overhead linemen's mates, and jointers' mates, &c., employed in the London district. It is thereby agreed that Rule No. 11 of the working rules agreed in February, 1920, shall read as follows:—

"The minimum rate for auxiliary workmen over 21 years of age (other than apprentices) employed in assisting journeymen shall be 80 per cent. of the rate paid to fully qualified journeymen."

That Rule 14 shall be added to as follows:—

"An auxiliary workman over 21 years of age shall be allowed to carry out any work of which he may be capable under the supervision of a fully qualified journeyman, and he may in time become a fully qualified journeyman as defined above. The following tools, kept in efficient order, are such as an auxiliary workman shall be deemed to possess:—Knife, pair of pliers, bradawl, small screwdriver."

It is further agreed that the above rate of pay shall come into the national agreement for standardisation of wages, and the said rate of 80 per cent. of journeymen's rate shall become payable on the first pay day in November, 1920.

By this agreement 2s. per hour is payable to all mechanics' mates, 21 years and over, in the employ of contractors and in other establishments, and is payable from the next pay day. Under the terms of this agreement and the agreement with the Joint Industrial Council for Electricity Supply Undertakings for the London District, the rate for electrical fitters' mates, mechanical fitters' mates, electricians' mates, wiremen's mates, jointers' mates and armature winders' mates is 1s. 11½d. from next pay day, and application should be made at once to electricity undertakings for this rate to be paid.

The memorandum is signed by Messrs. W. Riggs and G. E. Taylor, on behalf of the N.F.E.A., and by Messrs. H. P. Bolton and W. J. Webb, on behalf of the E.T.U.

STREET LIGHTING.—I.

By HAYDN T. HARRISON.

In these articles the writer had intended to record the progress of street lighting during the last ten years, but investigation indicates that little, if any, advancement has been made. This is largely to be accounted for by the war conditions which existed over the greater part of that period, and it is only now that there are signs of development, due to men having turned their attention to this branch of the lighting industry after their duties in connection with the war were over.

It is true that the gasfilled electric lamp has been developed into commercial importance during that period, but it is obvious that the increased efficiency of this light source, embodying as it does reduced consumption of electrical energy, increased brilliancy, shorter wave length, and reduced area of light source, is not being used to its full advantage, as these lamps are often found installed in unsuitable fittings, designed for lamps having totally different characteristics.

In an historical sketch of street lighting lately read before the Illuminating Engineering Society of America, Mr. Preston S. Millar states: "Progress in the development of illuminants has been more rapid than progress in their use. In practice each one has survived by many years, sometimes by centuries, the development of a superior illuminant." Of the truth of this statement there is no doubt, especially when it is borne in mind that the chief development in the nature of illuminants has been in the direction of shortening the wave length, and increasing the intrinsic brilliancy, which makes it of the utmost importanee that they should not be used in the same way as the less brilliant types.

From the early days when the fire-brand was used as a light source, through the period of oil lamps and candles, to the days of the Argand gas burners in 1784, a reduction in area of light source took place; again, from the time of the incandescent gas mantle and carbon-filament electric lamp, up to the present gasfilled electric lamps, we find another large increase in intrinsic brilliancy of light sources. It would, therefore, appear likely that further increase and development in efficiency will take place in the same direction, thus making it imperative that in order to benefit by these lamps of higher efficiency, the practice of erecting lamps in the streets without any special fittings will disappear, so that the full advantage of the new developments in the efficiency of light sources may be utilised.

Reference to the writer's paper, read before the Institution of Electrical Engineers in 1905, indicates that much of the progress in street lighting was brought about by the competition of gas and electric light for this particular field. Such competition was carried out up to the outbreak of war, when examples such as the lighting of the City of London, Holborn, Manchester, all of which were the subject of the keenest competition, resulted in both illuminants being adopted, because at that time it was proved that both could produce the desired results at approximately the same cost. Similar examples which apply to the less important streets, as in Marylebone, also proved the same thing, but when it is borne in mind that the newer illuminant had to bear certain capital charges, which in the case of the older illuminant had long since been written off, it is obvious that, excluding capital charges, electricity had already become less costly for street lighting purposes.

A reference to the *Gas World* Year Book of 1920 will show that in England, Scotland, and Wales there are approximately 670,000 street lamps lighted by gas.

The writer has no data before him indicating the number of street lamps lighted by electricity, but it is doubtful if it reaches one-tenth of the above figure, which indicates the large field open in this direction. From the same authority it is possible to ascertain the approximate price of gas in various towns, and to note the increased cost since pre-war days. In order to obtain this as regards public lighting an average has been taken for towns where the number of street lamps exceeds (A) 10,000, (B) about 5,000, (C) 1,000, (D) 300; these figures are shown in Table I, in which the average price per 1,000 cu. ft. for gas in the years 1914 and 1920 is given.

TABLE I.

A		B		C		D	
1914	1920	1914	1920	1914	1920	1914	1920
2/2	4/2½	2/3½	4/1	2/7	4/7½	3/10	7/-

This table indicates that the cost of gas has increased about 80 per cent.

In the case of electrical energy, it is interesting to note from the published returns that the average price received is as follows:—

TABLE II.

A	B	C	D
1·76d.	2·3d.	3·6d.	Data not obtained.

The foregoing data, in order to give some relative idea of the cost of the two illuminants for street lighting purposes, must be used in conjunction with the types of lamps now available for this purpose.

Dealing with gas first, the developments during the war do not appear to be of a startling nature; the latest figures published, namely, those by F. V. Westermaier in a paper read before the Illuminating Engineering Society of America (October, 1919) give the luminous efficiency as follows:—

Low-pressure upright gas mantle, .3 lumen per B.TH.U.

Low-pressure inverted gas mantle, .4 lumen per B.TH.U.

High-pressure inverted gas mantle, .525 lumen per B.TH.U.

With reference to high-pressure gas, Mr. Westermaier states that higher values have been claimed (.75 to .90) by foreign manufacturers, but passes no further remark except: "While its advantages are apparent, there is not sufficient revenue obtainable from street lighting alone to warrant the expenditure necessary for installation of special mains and fixtures."

This also appears to be the case in England; it is therefore only necessary to consider the low-pressure mantles.

Taking gas at 500 B.TH.U. per cu. ft., this represents a mean illuminating value of 200 lumens per cu. ft. per hour or 1,000 lumens for 5 cu. ft. of gas, which at 50 pence per 1,000 cu. ft. of gas, is equal to .25d. per hour per 1,000 lumens.

During the war the gasfilled electric lamp (which, due to the fact that under certain conditions, it will given an efficiency of 0.5 watt per C.P., is sometimes called the half-watt lamp) has been developed, and is now a commercial article. This lamp in the smaller sizes comparable with low-pressure gas mantles, and at the pressure generally supplied by electricity undertakings, develops an average of 12,000 lumens per Kelvin (Board of Trade unit) per hour, which at the average price obtained, Table II, A, works out at a cost equal to .0145d. per hour per 1,000 lumens, or 58 per cent. of that of gas in the same districts.

The same applies in nearly every class of district, therefore it is obvious that the public lamps are not being supplied with gas because it is cheaper as an illuminating agent. In fact, with the modern type of electric gasfilled lamps the luminous energy produced can be so efficiently utilised as to reduce the cost of electrical energy to a relatively small figure compared with the other charges incidental to street lighting. These other charges consist of lamp or mantle renewals, labour in carrying out these renewals, cleaning, lighting, and extinguishing. As regards the relative cost of lamp and gas mantle renewals, the electrical engineer is in a very sound position, as he has the

choice of both gasfilled and vacuum lamps; the former are at present more expensive, thus the increased cost of renewals must be set off against the greater efficiency.

In order to form an accurate judgment on this point it is necessary that the engineer should not be misled by the term "half-watt," which has led many lamp factors to circulate most misleading figures. The more responsible lamp makers have published with their price lists the actual output of the lamps in lumens, which, being a spherical factor, does not indicate the power in the maximum direction, but this with the standard formation of gasfilled lamps of 100 watts and over varies from 10 to 20 per cent. increase on the mean spherical result, thus the actual maximum C.P. (which occurs in the lower hemisphere) is equal to the luminous output divided by 12.57, plus 10 to 20 per cent.

The published tables and actual results in practice indicate that the lumens per watt increase very considerably with the size of the lamp, namely, from 12 to 18, depending on the pressure and current taken by the lamp; for example, a 100 watt, 200/250 volt lamp is scheduled at 1,200 lumens, or 96 mean spherical C.P. (about 115 maximum C.P.), whereas a 1,000 watt, 100 volt lamp is scheduled at 18,000 lumens, 1,435 mean spherical C.P. (or 1,700 maximum C.P.), thus on the maximum, say, the latter has an efficiency of .59 watt per C.P., whereas the former is a one-watt lamp on the spherical basis.

In the case of the 60-watt, 200/250 volt gasfilled lamp, the present efficiency is stated in the list before me as 9.15 lumens per watt, which is very little better than the vacuum lamp; as one costs nearly double the other and does not average the same life, it should only be used when special reasons demand it.

It must be borne in mind that the popularity of gasfilled lamps is not only due to the increased luminous efficiency, but in the smaller sizes, where this reason does not exist, to the higher intrinsic brilliancy which, due to the shorter wave length produced, gives an impression of more light, and, in fact, does increase visibility of objects with certain reflecting values, more particularly the contrast between black and white, thus making it easier to read.

Small area of the light source is generally a disadvantage, particularly in the case of street lamps, unless this feature is turned to advantage by the use of special reflector systems, when it can be made to increase the efficiency for that purpose to a degree which has hitherto appeared impossible.

The cost of renewals must, therefore, be dealt with in conjunction with the other costs, as it bears no definite relation to the luminous output of each size of unit; for example, a 300-watt lamp giving four times the luminous energy of a 100-watt lamp costs less than twice as much for renewals, thus the question of spacing materially affects the results, all of which will be dealt with in detail in the second article.

The lighting, extinguishing, cleaning, and attendance with electric incandescent lamps, for well-known reasons, costs less than with any other systems of street lighting; it is, therefore, obvious that there are no reasons why the hundreds of thousands of street lamps now lighted with gas should not be changed over to the more modern illuminant *except* that of the initial cost of the change over.

The question is, will the improved illumination and the reduced annual expenditure warrant this cost at a time when material and labour is expensive?

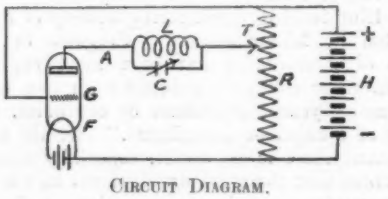
The question can only be answered in figures, which the writer proposes to give in his next article; in the meantime, as food for reflection, it is well to remember that private concerns, large companies, shopkeepers, in fact everybody who could get it installed, have adopted electric light, knowing that the cost of installation would be well repaid by the saving effected. This is in itself proof that municipalities, and those bodies who control the question of public lighting, would do well to look into the question of the future saving to be effected by modernising the lighting of the streets and roads under their control.

AN ORDINARY TRIODE USED AS A NEGATIVE RESISTANCE OSCILLATOR.

By JOHN SCOTT-TAGGART and J. REE.

Although it is not generally known, the ordinary ES 4, R. or French valve, as commonly used, may be employed as a negative resistance oscillator, by virtue of the phenomenon of secondary electron emission utilised by Dr. Hull.

A suitable circuit is reproduced in the accompanying figure. A potentiometer R is connected across a source of E.M.F., which may be a battery H, or 110-volt or 200-volt D.C. mains. The actual voltage is not very material, nor is the value of the resistance of importance. The grid G is connected directly to the positive end of the potentiometer R, the negative end of which goes to the filament. The anode P is connected through the oscillatory circuit L C to a sliding tapping T; the anode potential may thus be varied, and will be usually considerably less than that of the grid. When this circuit is connected up, a suitable adjustment of T will establish continuous oscillations in L C. The explanation is that the anode current decreases as the anode



Circuit Diagram.

potential is increased, thus producing a negative resistance in the circuit containing L C. The very high positive potential of the grid causes the electrons to strike A with a sufficiently high velocity to liberate more secondary electrons than the number of primary ones which strike this electrode. These secondary electrons would normally return again to the anode, but the higher potential of the grid draws them away. As the potential of A is increased, the number of secondary electrons (which are immediately drawn away by the grid) increases very rapidly, although the primary electrons increase hardly at all. The anode thus loses more electrons than it gains. Hence the negative resistance effect which will set up oscillations in any kind of oscillatory circuit placed between A and T. An iron-core low-frequency circuit is "oscillated" as easily as a circuit of the highest frequency. Moreover, the frequency of the oscillations is practically equal to the natural frequency of the circuit. No troublesome retractor coils are used, and the arrangement provides a means of obtaining alternations of any frequency.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Technical Education.

At the ninth annual meeting of the Western Centre, held at the South Wales Institute of Engineers, on October 13th, an address on "Technical Education" was delivered by Principal C. Cole, B.Sc., of the Cardiff Technical College. He said that 5,000 students were enrolled at the Cardiff Technical College this session, 4,500 of whom were evening students. Classes were quite voluntary, and he estimated that the technical education scheme of Cardiff embraced something like 8,000 students, or 4 per cent. of its population. It was hoped to convert some of the evening classes into part-time day classes, as the strain of three evenings at school and another at home was considerable, and left no time for social enjoyment. They had one striking example of part-time day classes established this year, taking three afternoons and two evenings a week for the first and second year apprentices of the electrical firms in the district. It was necessary to take a three years' course in their junior schools before completing an apprenticeship. There was, however, the difficulty of accommodation, in addition to which the people in Wales were not keen on junior schools where manual lessons formed part of the curriculum; they preferred something approximating to the secondary school. In England this system was making headway, but in Wales it was rather the reverse. The Principal described the local scheme, which he hoped in time

might lead to the installation of a Faculty of Technology at the University of Wales. Referring to the 1918 Act, the Principal said the effect of that Act would be a system of new continuation schools. He thought there would be great difficulty in applying the compulsory side of the Act. The effect of the Act in technical colleges would, he considered, be beneficial, and there was no reason why Cardiff should not possess one of the finest engineering schools in the country. They had already £20,000 worth of equipment, and he wanted employers to work and co-operate with them. They were making a point of introducing economics and social organisation which he considered would do something to bridge the gulf between Capital and Labour. With regard to higher work, he emphasised the necessity of co-operation between various institutions in order to avoid overlapping and needless expenditure.

Post Office Telephones.

Following the address by Principal Cole, a short *résumé* of what the Post Office was accomplishing was given by Sir William Noble, who had attended a meeting of the Cardiff Postal Engineers during the afternoon. Sir William said the Post Office telegraphs were ahead of any other country in the world. There was no invention appertaining to telegraphy that did not first come to the British Post Office, because the inventor knew that not only would the Post Office help him, but give his system a trial. He considered the mail, telegraph, and telephone services should be controlled by the public. The Post Office had no difficulty regarding money; the Treasury did not grudge anything. As to brains, he said that, apart from those who were in manufacturers' works, all the telephone experts were in the service of the Post Office; they had at present in the engineering department alone over 26,000 who were engaged on the telegraph and telephone sides of the Post Office, and a good many more could be employed, but the Post Office was ahead of the contractors. Contractors could not supply more apparatus because of the shortage of raw materials. Apparatus was unobtainable. Before the war no difficulty was experienced in getting from every one of the big contractors a minimum of three miles of 3-in. cable for trunk mains work; they were now very glad to get a mile of it.

Following an account of the P.O. staff's war service, Sir William said that last financial year the Treasury allotted three millions sterling for stores and apparatus, and contracts had been placed for underground lines and exchange equipment amounting to two and a half millons sterling, but delivery was unobtainable, due to shortage of raw materials. This year they were in the same position; inquiries had been prepared, but they dared not send them out. Before the war a job took a contractor six months, now for similar work delivery would not be guaranteed for twelve months. A 10,000-line exchange would have been completed in a year, the earliest delivery now was two years. A contractor informed him only the other day that he could not deal with any further tenders until next March. He could assure them it was no fault of the Post Office, their trouble was shortage of raw materials and labour. At Cardiff orders for necessary extensions had been placed many months ago, but the contractor had not even started. Plans had been passed for work at Cardiff for 33 years ahead. Concerning automatic telephones, there was very little to choose between the automatic and the "C.B." systems, when they had a plentiful supply of skilled operators. There was not a single full automatic exchange in America, but the British Post Office had already installed automatics at Leeds, Portsmouth, Newbury, &c. The automatics had been "proved in," and it was the intention of the Post Office to proceed with them. The Americans only excelled in their trunk systems, their local service was not any better than our own. Much of the success attained by America was largely due to research work. Sir William, in concluding, counselled patience.

THE AIR CONFERENCE, 1920.

The Air Conference, consisting of representatives of aviation in all its many branches, was held, by the courtesy of the Lord Mayor, in the London Guildhall, and lasted for three days, from October 12th to 14th. It was organised by the Ministry of Air with the object of bringing together interested persons under such conditions that urgent problems could be discussed with the knowledge that resolutions of the Conference, arrived at after much discussion, would be welcomed by the Ministry as being of assistance to the Secretary of State for War and Air. The Conference was well attended; the Lord Mayor welcomed the members, and Lord Montagu of Beaulieu, Lord Weir of Eastwood, Lord Beatty, and Lord Londonderry, Under Secretary of State for Air, presided in turn, and the audience was able to learn at first hand official views on the subjects under discussion. The Conference was widely representative, and although not of direct interest to our readers, some of the statements in the various papers that were read and discussed are worthy of consideration; for instance:—

Commander Sir Trevor Dawson, Bart., R.N., in the course of his paper on "The Commercial Airship—Its Operation and Construction," said that postal services by airship would fill the gap between cable communication and the present mail services. A letter weighing an ounce could contain some thousands of words, and if the cost of cabling only a single word were charged for its carriage by air, the airship transport company would be handsomely remunerated. With regard to the danger of passing through electrical storms, information had been published that the German airship *Bodensee* had actually passed through an electrical discharge without other damage than the burning of the wireless aerial. There was no reason why airships should ever encounter the violent thunderstorms and cyclones which occurred in various parts of the world, as such storms extend over a very small area, and there should be no difficulty whatever in the airship being able to avoid them. Means of signalling at night were essential, and the wireless equipment should be such as to enable an airship *en voyage* to be in constant communication with the nearest base.

Captain F. S. Barnwell, Fellow of the Royal Aeronautical Society, in his paper on "The Technical Aspects of Service and Civil Aviation," said that should it be found practicable to dispense with the electrical ignition, even if only after "warming up," it would mean considerable increase in reliability. The transmission between the controls and the control surfaces was confined at present to cables running over pulleys and through guides. It seemed conceivable that some system of either hydraulic, or electrical, transmission might be worked out, and if such a system could be made as reliable as the direct, though often tortuous, cable, it would probably be smoother in working, and easier to install. The logical development of the idea was the servo-motor. When they built really large aeroplanes it would probably be found the best practice to work all controls directly by servo-motors, the leads becoming hydraulic piping or electrical cables.

Mr. H. White-Smith, chairman of the Society of British Aircraft Constructors, Ltd., in his paper on "The Creation of Civil Aircraft in Relation to the Constructor," said that nearly all forced landings of machines pointed to the necessity of all machines being fitted with wireless telephones, together with directional wireless apparatus being installed at the terminal and intermediate aerodromes, as, in each case, had that been done, it should have been possible to complete the flights successfully. Most of the transport companies of to-day were anxious to have wireless telephones fitted to their machines as soon as possible, but, while that was not difficult, there still remained a certain amount of work to be done in perfecting the ground organisation at the foreign aerodromes for the wireless telephone and the installation of directional wireless apparatus. The importance of having wireless fitted to all machines could not be over-estimated, although without the co-operation of an efficient international ground organisation, it would be of little value. The present position cannot be considered satisfactory, and he pressed on the Air Ministry the importance, in the interests of civil aviation, of continuing to perfect the wireless ground organisation in this country, and also of endeavouring to persuade foreign Governments to take similar steps. From the aircraft constructor's point of view the installation of wireless presented little difficulty, but he suggested that in future the constructor and the wireless expert should co-operate to ensure the correct and convenient installation of all apparatus. It was possible, by the production of suitable instruments and the development of directional wireless, to make aircraft more independent of fog than other modes of travel. It would be entirely in the interests of commercial aviation if the Government could carry out a series of experiments to determine the best form of arrangements for lighting up aerodromes and for landing purposes at night. Constructors, in conjunction with the lighting experts, should try to perfect some means whereby aeroplanes flying by night would be able to carry with them apparatus whereby they could light up the ground underneath, and give them some reasonable chance of landing in safety. The apparatus so far produced did not by any means meet the need which, sooner or later, must arise.

Major-General Sir F. H. Sykes, Controller-General of Civil Aviation, dealt with the subject of "Civil Aviation and Air Services," and said, *inter alia*, that the safety of aircraft depended largely upon their engines perhaps even more upon their accessories, ignition systems for example. An important factor was the efficient testing of materials, and the use of X-rays to reveal flaws in timber had proved valuable. In estimating the factors making for reliability they must take into consideration the importance of the timely issue of weather forecasts, and devices for "direction finding" by wireless in cloudy and misty weather. A problem of considerable difficulty was the ground organisation for night flying. Aerial lighthouses had been in operation for some months at Biggin Hill and Croydon, another would shortly be located at Lympne, and a third between London and Folkestone. Permanent electric landing-lights and lights marking buildings were being installed, and experiments were being made in the use of a searchlight for showing up obstructions on the aerodrome, the illumination of wireless towers and flood lights. Another important factor in the organisation of air navigation by night and in fog or mist, was the installation of an efficient wireless direction-finding and wireless telephone system. The direction-finding apparatus installed at Croydon enabled aircraft to correct their course at night, or in thick weather. He impressed upon aviation transport firms the great importance in the interests of safety and

regularity of every commercial machine being equipped with wireless. A machine thus equipped with directional wireless could ask for and check its bearings as often as necessary. An interesting instance of the value of wireless telephony was afforded recently when an aeroplane with ten passengers on board which was forced to land at St. Inglevert after dark was able to ask for landing lights from the air. By a combination of wire and wireless, it was now possible to speak from an aeroplane to an office in London, via Croydon, and *vice versa*. Wireless stations had also been opened at the civil aerodromes at Castle Bromwich, Didsbury, and Renfrew. The time required for a wireless message to pass between the sender at the London terminal aerodrome and the recipient at Paris had been reduced to an average often to twelve minutes. British proposals for the new International Radio-Telegraph and Telegraph Convention, which were being laid before the International Conference at Washington, included those connected with all forms of communication to and from aircraft. Meteorology was largely dependent upon good communications, such as by wireless, and the communications branch of the Department of Civil Aviation was able to give much assistance. The introduction of wireless telegraphy and its wide adoption by the mercantile marines of all countries had also provided means for placing at the disposal of meteorologists the observations over the sea for use in the preparation of forecasts. The equipment of lightships with wireless might in the future provide further assistance in this direction.

Air Vice-Marshall Sir E. L. Ellington, Director-General of Supply and Research, in a paper on "The Present Position of Aircraft Research and Contemplated Developments," said they were developing two engines which were quite different from the normal aeronautical engine. As regarded landing lights, since flares could not be put out and relit, a system of electric lamps to be carried on the wings was being developed in substitution of the wing-tip flares, so that a pilot could switch the lamps on and off as required. There were two methods now under investigation for indicating to the pilot his exact height above the ground and his position with regard to the aerodrome. The first made use of the sound given out by the engine. A number of microphones were arranged symmetrically over a considerable area. Means were provided by which a microphone only received the sound of the engine when the machine was passing through the cone of the atmosphere at the apex of which the microphone was located. The time taken by the machine between entering one cone and entering the next gave the speed over the ground, observations from a number of instruments whose positions were known gave the direction of flight, and from the speed, the time taken to traverse completely a cone and the angle of the cone which was known, the height could be calculated. Thus the course, the height above the ground, and the speed over the ground could be ascertained, and sent to the pilot in the machine by wireless telephone or telegraph. A further development consisted in having the sound producer on the ground and the receiving apparatus in the aeroplane. A cone of sound was formed, directed upwards at a suitable angle, and the pilot flew down that cone of sound in order to reach the aerodrome. When electrical oscillations were set up in any circuit, the frequency of the oscillations depended, *inter alia*, upon the electrical capacity of that circuit. In the "Proximeter" two conducting surfaces were fixed on the under sides of the planes and had a capacity effect between them. When a third conductor, such as the sea or wet earth was brought near to them, their mutual capacity effect was altered. Consequently the frequency of the oscillations in the aeroplane circuits would be altered and the amount of alteration would depend on the distance between the aeroplane and the third conductor (wet earth or sea). A small lamp in series with an independent circuit could, by suitable couplings, be made to glow whenever the natural frequency of that circuit was in tune with the one mentioned above. By arranging a series of such lamps and independent circuits, each of which varied slightly in frequency, it should be possible to get each one successively in tune with the original circuit and consequently to get each lamp in succession to glow as the machine approached the earth. Protection against fire due to sparks from magnetos was being sought by making them fireproof, and the problem had been under investigation at the National Physical Laboratory and the Royal Aircraft Establishment for some months. Mechanical means of starting aero-engines were being developed. A starter which was no part of the machine, but of the aerodrome equipment, could now be provided, and two patterns had been tried successfully. The design of a starting apparatus within permissible weights which formed part of the aeroplane or engine was a matter of much greater difficulty. Various methods of charging the cylinders and firing them by means of an auxiliary magneto had been tried without complete success. An auxiliary engine for the purpose was being tried which showed considerable promise of success. The total weight of the apparatus was approximately 40 lb.

New Research Association.—A licence has been issued by the Board of Trade to the British Motor Cycle and Cycle car Research Association, which may be approached through Major H. R. Watling, "The Towers," Warwick Road, Coventry.

TURKEY: AN UNDEVELOPED MARKET.

For the electrical manufacturer, the development of trade with Turkey lies in the fairly distant future rather than in any near prospect. It is, however, satisfactory to learn from the report of H.M. Commercial Secretary at Constantinople that Britain's commerce stands high, and can hold its place despite the disadvantages resulting from her geographical position, from which, amongst her competitors, the United States and Japan alone are likely to suffer. These latter countries are two which offer very active competition in the world's markets, in electrical lines.

Use of Electriçity.

Electricity was scarcely used in Turkey during the reign of Abdul Hamid, who, it is said, thought that dynamo and dynamite were identical. Private installations for electric lighting were not unknown in Constantinople during the latter years of his rule, but it was impossible to secure any concession for producing electricity for public use. After the revolution of 1908, however, the tramways were bought up by a German combination, called the Union Ottomane, Société pour Entreprises Electriques en Orient, domiciled at Zurich, and working through the Deutsche Orient Bank. This combination, which is somewhat similar in character, and probably in composition, to the Banque de Chemins de fer Orientaux, obtained authority to construct many new lines, to run tramways over the new bridge between Galata and Stamboul, and to work the system by electricity. Subsequently it secured concessions to supply the whole of Constantinople with electric light and power, though it was not till the spring of 1914 that its efforts were finally successful. The total value of these various concessions is, of course, very great.

The following are the companies forming the group known as the Société Financière de Transports et d'Entreprises Industrielles; Les Tramways de Constantinople; La Société Ottomane d'Electricité; La Société du Tunnel (funiculaire); La Société du Métropolitain (this company has not yet commenced working).

The company is entirely Belgian, and has been established in Brussels for the last 15 years. The trust is under the management of Mr. Daniel Heineman, an engineer, of North American birth and nationality, two Belgian directors, and one American director, and all the rest of the staff is Belgian.

The capital invested in the various enterprises of the trust represents nearly 1,000,000,000 fr. When this company decided to take up the various concessions in Constantinople these were under separate management.

The question arising of electrifying the tramways and creating an electric plant, all the different concerns were grouped together under one concession, which created the Société Belge des Tramways et Electricité de Constantinople, a company which holds the largest amount of shares in each of the sub-societies. The subscribers to the Belgian company are international, and the following gives an idea of the share subscribed by the various nationalities:—

	Fr.
German	23,000,000
French	25,000,000
Belgian	18,000,000
Swiss	6,000,000
Hungarian	9,000,000
Group Giros Loucheur, Paris ...	9,000,000
	90,000,000

The Constantinople public holds shares amounting to 19,000,000 fr. of an issue made during the war in Constantinople.

All the material for the tramways, such as rails and aerial lines, came from Belgium, cars from Germany and Belgium, cables from France. The material of the "Société d'Electricité" was furnished by the firm of Ganz, Budapest, the engines, transformers, and cable system by G. Loucheur, Paris.

There is nothing to be done in selling electrical material until the Conference definitely decides the fate of Turkey, as, although most of the towns in the interior want to carry out electrical installations, the necessary financial arrangements cannot be made. A large quantity of electrical fittings, &c., of Italian and German manufacture, have come on the market.

As far as machinery generally is concerned, there is a big demand for all kinds of wool-working machines and agricultural machines, but deliveries from the United Kingdom are very unsatisfactory.

Meeting Competition.

It may be mentioned that a very strong American combination with a capital of five million dollars commenced operations in Constantinople during the summer, sending at intervals boats from America with their goods, and on their boats "*motor lorries to deliver the goods to their customers.*"

It must be borne in mind that, although for the time being Germany and Austria are not in a position to trade, before the war they had almost captured the market in metals and some few other articles, and in the near future are almost sure to make the same attempt again.

It has been found that the British manufacturer places himself at a disadvantage by quoting in most cases f.o.b. United Kingdom port. The advantage to all communities of c.i.f. over f.o.b. prices is apparent, the more so in places like Turkey, with a big native population, where, through fierce competition among native dealers, the margin of profit in normal times can only be narrow.

German firms especially were greatly assisted by the large information offices, which were in a position to furnish detailed reports on the standing of every possible purchaser of their goods, thereby checking their representative's report, and avoiding dealings with all dubious customers. This facility is now available for United Kingdom traders by applying to the Commercial Secretary attached to the High Commission at Constantinople.

There is a British Chamber of Commerce at Constantinople, one at Smyrna, and in addition there are French, American, Greek, and Turkish Chambers of Commerce. Public exchanges are unknown.

British traders are urged to exercise great care in arranging their representation in the Turkish market, and in entering into business with firms or individuals whose credit has not been properly certified and proved. The above-mentioned organisations can be of assistance in this respect.

Industry and Fuel.

Out of 282 industrial establishments existing in Turkey, 249 installations are worked by power furnished by steam engines. Petrol and benzine engines are secondary. Only in Constantinople are electric power plants found. Native coal is used for combustion.

The personnel of the factories totalled up to 16,975 workmen in 1913, but owing to the war there were only 14,060 in 1915. No new industries have been commenced since the Armistice.

About one-half the manufacturing enterprises of the country are carried on in the neighbourhood of Constantinople, thus showing that the capital ranks first as the industrial centre of the Ottoman Empire with regard to the number of workmen employed and value of production. The Smyrna area comes next with 59 factories, then Brousso with 46.

With regard to fuel supply, Turkey during the war received a regular supply of coal from Germany. In addition, the Turkish Heraclea coal field had been under military supervision and forced labour employed there. This labour is now dispersed. An Allied Coal Commission was formed to cope with the shortage, and reported various needs as follows:—

Anatolian Railway, with a consumption of 300 tons daily, Oriental Railway, with a consumption of 100 tons daily, electric light works with a consumption of 150 tons daily, water supply, mills, &c.

An inspecting officer was sent out to the Heraclea coal field and reported that the then actual output was barely 150 tons per day, but with proper organisation and a sufficient supply of labour the output should meet full requirements by the end of January. This view turned out, however, to be optimistic.

It was insisted that the Turkish Government should take definite and urgent action in supplying labour, and during the month of January the Heraclea mines succeeding in producing 300 tons daily, which in February increased to 600, and later to 2,000 tons daily (at T.30 per ton).

Urgent efforts are being made to increase the output of the Ayasma lignite mine situated some two hours only from Constantinople. The difficulty up to the present has been the question of labour. Recently 200 Chinese have been imported, and it is hoped when this mine reaches its full output there will be a marked improvement in the fuel situation in Constantinople.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Road Transport.

In reply to the letter appearing in your issue of the 15th inst. from the Hon. Secretary, Institute of Transport, it appears that my previous letter has been incorrectly read by Mr. H. S. Blair, as I distinctly referred to "those who have consented to become members of the Council," and said that "with the exception of Sir H. P. Maybury, I fail to find in the list the names of any who are acquainted with modern road work."

Tractor.

October 26th, 1920.

Cost of Living in India.

In your issue of March 26th last, there appeared a very interesting letter on the above subject from "West India." At the time I read it I had no idea of going to India, but now I am offered an appointment in Bombay, and if any of your readers can furnish any further particulars on this subject, I am sure they would be of very general interest and assistance.

In my case, I am a married man, and owing to the housing question, which appears to be worse in Bombay than in England, I shall not be able to take my wife out for twelve months. Incidentally, I could not afford to pay her passage out at present, and therefore I must keep myself in India, my wife at home, and also a boy at school.

One does not wish to go to India unless one can put something by, which should be fairly substantial, and if any of your readers can say what, under these circumstances, an average salary should be, allowing for reasonable comfort and entertainment, which I believe is essential in India, I should feel very much obliged.

May I put it this way: If £600 per annum will meet one's needs in this country, what should one expect to receive in India?

Then, is it usual for the employer to make an allowance towards cost of outfit; if so, how much?

What are the usual terms of agreement for a five-years' appointment? Is it customary to allow six months' leave at the termination of the agreement, with pay, whether returning or not?

What is the customary procedure in the event of prolonged illness?

What clubs should one join, and what, approximately, are the subscriptions?

Is it usual to have any clause in an agreement for five years, whereby the appointment may be terminated at an earlier date?

M.I.E.E.

October 27th, 1920.

[A note on p. 117 of our January 23rd, 1920, issue, and letters in our "Correspondence" columns, p. 414, September 26th, 1919; p. 415, March 26th; p. 618, May 14th; p. 107, July 23rd; p. 172, August 6th, 1920, will furnish information on the above subject.—Eds. Elec. Rev.]

Mechanical Details of D.C. Armature Construction.

Referring to the article you publish this week by "London Foreman," I cannot imagine a firm to-day which could afford to adopt the suggestions or methods which he expounds, and run a profitable business.

I have been on every class of work from small machines up to A.C. and D.C. turbines; also Admiralty work such as submarine main motors and battleship generators, and even these do not depart from the straight bored spider, which is only in special cases made of cast steel, in place of cast iron. The flanges forged solid with the shaft suggestion takes us back to the days when Mr. Elwell Barker commenced business.

The slack fitting spider which is so humorously supposed to be the cause of all trouble and expense, has no connection with the foreman, but with his book, "returns of wasters." The use or rejection is decided to-day only by the inspector, and he only is responsible.

Perhaps "London Foreman" may find the following interesting books worth looking at now and again: "Armature Construction, Electric Motors," by H. M. Hobart; "Dynamo Design," by G. Kapp; "Design and Specification of Dynamos," by Miles Walker; "Commutator Construction," by R. Livingstone.

W. S. Daniels.

Leeds, *October 26th*, 1920.

Power Factor.

I expect you feel that the discussion on power factor has continued long enough, but Mr. C. Turnbull's article in your current issue leaves me no course but again to enter the field. Whilst carefully setting out my oversight, which I admitted and corrected without assistance or criticism to call my attention to it (my letter was written and dated September 19th, and would have appeared the same week as Mr. Turnbull's reply but for pressure on your space), he carefully does not admit the oversight he made, which I criticised, but covers it by quoting the true state of affairs from Dr. Thompson's valued works, as if that were his statement all along.

Then he goes on to state: "If the periodicity were reduced to one per two minutes . . . on nearly wattless load, we would see that it was running on load for one minute, whilst during the next minute the current would be surging back and motoring the generator." Again the same error as the one I criticised. The earlier part of the article is the proof. When the current is surging back for the second minute there will be power from the generator for ½ minute and power back motoring for ½ minute, partial periods IV and I being equal, for "wattless" or "quadrature" current, to use my suggested term. The power does not follow the current, but follows the rate of change of the current which in turn causes the alternating magnetic flux.

I believe I could explain to any hard-headed business man how this alternating power, in maintaining his alternating magnets, causes "electrical friction" losses in the circuits and necessitates larger plant to all concerned, without any analogies, and I shall never use the banker's analogy, because it is not a true one. In one case the supply company charges the consumer for allowing current to come to his motors and be returned, whilst in the other the banker who receives and returns the "wattless" money charges the money supplier. As Mr. Dorey aptly quoted—"when they are good they are very, very good, &c."

Chas. H. Harvey, B.Sc. Lond.

Ponders End.

October 31st, 1920.

LEGAL.

Middlesbrough Tramway Arbitration.

Mr. Justice Rowlatt, in the King's Bench Division, on October 26th, had before him a special case stated on an arbitration between the Imperial Tramways Co., Ltd., and the Corporations of Middlesbrough, Thornley, and Stockton-on-Tees, relating to the purchase by the three boroughs named of the tramway undertaking in their area.

Counsel for the Tramways Co. announced that the Corporations had decided not to contest the award of the arbitrator as to the amount payable for the acquisition of the tramway undertakings.

Mr. Eustace Hills, K.C., for the Corporations, assented to the statement, and his lordship made an order confirming the award, and giving costs to the Tramways Co.

Oldham Tramway Arbitration.

Mr. Justice Rowlatt, in the King's Bench Division, on October 27th, had before him for decision a special case arising out of an arbitration relating to the compulsory purchase by the Ashton-under-Lyne and Hyde Corporations and the Audenshaw and Denton Urban Councils of the tramway undertaking of the Oldham, Ashton & Hyde Electric Tramway, Ltd.

Mr. Knox, K.C., for the municipal authorities, said the points raised by special case were what items in calculating the cost of the tramways were subject to depreciation. The arbitrator found with regard to certain items that no depreciation ought to be made in calculating the purchase price. The Corporations concerned contended that these items should be reduced by allowances for depreciation. The first item was engineering. The arbitrator had found in favour of local authorities on that item that allowance should be made for depreciation. With regard to other items for preliminary expenses, cost of raising capital, interest on capital during construction, and cost of temporarily removing part of the tramway owing to alterations to Guide Bridge, the arbitrator made no allowance for depreciation. The arbitrator had awarded £142,174 as the value of the tramway undertaking on May 1st, 1918, taking into account depreciation, but, said counsel, no depreciation was allowed in respect of the items he had mentioned, and in respect of these items the local authorities contended that either nothing should be allowed in the purchase price, or if it was allowed, it should be subject to depreciation as part of the tramway as a structure.

Mr. Clode, K.C., for the Tramway Co., argued that whether depreciation should be taken into account or not in respect of the items challenged was a question of fact entirely at the discretion of the arbitrator, and the Court ought not to interfere with his findings.

Mr. Justice Rowlatt, in giving judgment, said the proper method of arriving at the purchase price of the tramway was to take the cost of the undertaking as a profitable concern subject to depreciation. In his opinion the arbitrator was justified in making allowance for preliminary expenses. Cost of raising capital was an item which could not be allowed, but interest on capital during construction was part of the cost of the tramway, and the arbitrator had rightly made allowance for that item. He could not see that the expense of altering Guide Bridge was part of the expense of constructing the tramway; therefore, the arbitrator was not right in making allowance for that item. His lordship supported the arbitrator's view that the round figure he took for preliminary expenses was a non-depreciable article, and nothing should be deducted for depreciation. Interest on capital was depreciable with the capital on which it was interest, part of which was depreciable and part non-depreciable. The award must, therefore, go back to the arbitrator for analysis and adjustment of that item. There would be no order as to costs.

Damages Awarded Against Newcastle Corporation.

At Newcastle-on-Tyne County Court, on November 1st, the Under-Sheriff (Mr. J. H. Youll) sat with a jury to assess damages in an action arising out of a tramcar accident, brought by Mr. James William Dobson, carrier, of Seaton Delaval, and his wife, against the City Corporation. The liability of the defendants had been admitted, and the case had been remitted from the High Court for the assessment of damages.

Mr. E. Meynell, for the plaintiffs, said Dobson was, at 6 p.m. on January 8th last, proceeding to Seaton Delaval with two carts, and was walking on the left-hand side of the second cart; Mrs. Dobson was on the right-hand side. When a short distance from the city, Mrs. Dobson saw a tramcar approaching behind, and shouted, but before the carts could get clear, the car ran into the back of the second cart. Mr. Dobson received a compound fracture of the right arm and a scalp wound. Mrs. Dobson was suffering from shock. The claim was for personal injuries, wages for a man who had to be engaged during Mr. Dobson's disablement; for the upkeep of a horse till it died, the value of the horse, &c.

Mr. H. S. Mundahl, for the Corporation, said it was willing to give the Dobsons reasonable compensation, but he asked the jury not to treat it as a windfall for Dobson.

Mr. Dobson gave evidence about various payments. He said he had now a motor car, but his nerves were so bad he could not drive it in the busy thoroughfares of the city.

Mr. Collingwood Stewart, consulting surgeon, said there was now nothing in Dobson's condition to interfere with his working ability.

The jury assessed damages for personal injuries to Mr. Dobson at £200, and to Mrs. Dobson at £50; other items brought the total to £471.

Carmarthen Electricity Supply.

On November 1st, the King's Bench Divisional Court, consisting of Justices Rowlatt and McCardie, heard the appeal of the Carmarthen Electric Supply Co., Ltd., from a decision of the County Court Judge at Carmarthen given in favour of Mr. H. W. Thomas, of Queen Street, Carmarthen, against whom an action had been brought by the company in respect of the supply of electricity.

Mr. Clayton, K.C., for the company, said the amount in dispute was extremely small, but the matter was one of very great importance, because it related to the cost of the supply of electric light to the borough of Carmarthen, and whether a particular order regarding the increase in the cost owing to the war was effective or not. The defendant was charged for the quarter between September 29th and December 25th, 1919, for 129 units at the rate of 9d. per unit, £4 16s. 9d. He paid at the rate of 7d. per unit—£3 15s. 3d., and it was for the balance that he was sued. The County Court Judge held that the company, which was the lighting authority for the borough of Carmarthen, was not entitled to charge at the rate of 9d. without the consent of the Carmarthen Corporation, and that that consent had not been given. To that there were three answers. First, that the consent had in fact been given. Secondly, that the consent was wholly unnecessary, because this was not an agreement that related to the lighting of public streets, and consent was only required under the original terms of payment, and did not apply to these emergency powers that were given by the statute passed owing to the extra expenses of manufacture caused by the war. Thirdly, that any agreement to which consent was required was an agreement between the plaintiff company and the Corporation, and as the defendant was not a party to the agreement, he had no right either to enforce it or take advantage of it. The Judge held that he was in substance a party because he was a burgess, but if that were so it would mean that any burgess could sue upon any contract entered into by the Corporation.

Mr. Justice McCardie: And he would have the privilege of being sued.

Mr. R. C. Vaughan, for the respondent, contended that the company had no right to raise the charge above 7d. per unit, which was the limit fixed in its agreement with the Corporation, unless a fresh agreement was entered into.

Mr. Justice Rowlatt said he could not see the slightest answer to the company's demand.

Mr. Justice McCardie agreed. The appeal was accordingly allowed, and judgment entered for the plaintiff company with costs.

Claim for Commission.

At Lambeth County Court, before Deputy Judge Hodges, on Friday last, Braithwaite C. Rayner, engineer, of 9, Regent Street, London, brought an action against the Telegraph Condenser Co., Ltd., of Vauxhall Street, Kennington, to recover £100, one month's proportion of commission on the sale of electric sparking plug testers.

Plaintiff stated that he entered into an agreement to sell the plug testers on a commission of one shilling for every one sold. By mutual arrangement he devoted the whole of his time to this, guaranteeing a sale of 20,000 in the first year. He started selling them on October 18th last year, and received in commission £875. He stopped selling in March, when there was some dispute as to the amount of commission due to him. He prepared a return showing that £767 was still due, and he had an interview with Mr. Dearlow, managing director, and Mr. Cole, the manager. As a result they agreed to accept his figures as to £767 being due to him, and he then received a cheque for £150 on account. The balance was to be paid £100 a month. In May, June, and July he received £100, but not in August, and it was the £100 due to him in August that he was now suing for. He produced correspondence in which defendants agreed to pay him as stated.

Deputy Judge Hodges said the letters showed that the commission was due to the plaintiff, and that defendants agreed to pay it at the rate of £100 a month. He gave judgment for plaintiff for £100 claimed, with costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electrically Distance-Controlled Searchlight.

Fig. 1 shows an electrically distance-controlled searchlight, of which the London Electric Firm, Brighton Road, Croydon, has made considerable numbers lately. This machine is of very strong construction, being made generally on the lines of this firm's 24-in. naval projector, the candle power at the arc with normal current being 25,000.

A patent combined automatic and hand feed lamp is fitted, which enables the change-over to be made without interfering with the light. A separate controller is employed, and the machine is provided with separate motors for operating each

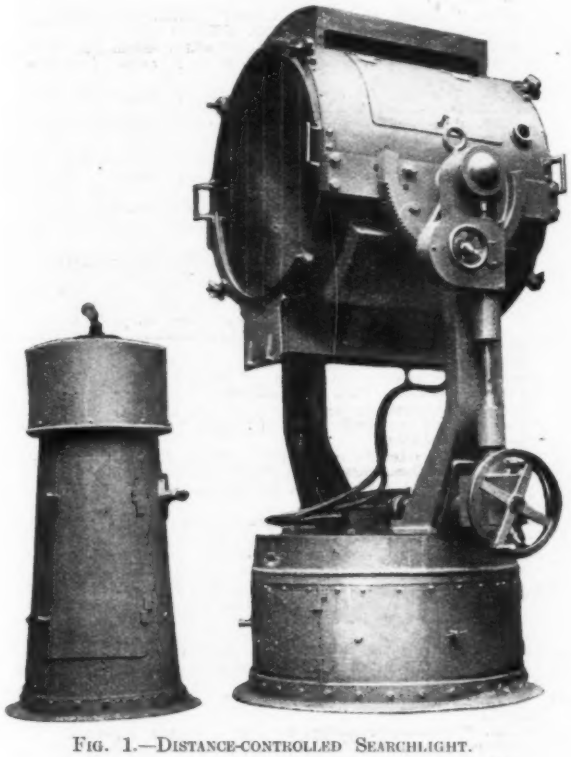


Fig. 1.—Distance-controlled Searchlight.

motion, both being fitted within the base, and with the exception of the elevating quadrant and pinion, all the gearing is totally enclosed. Local hand control is provided with both geared and free movements for tilting and training.

The construction of the searchlight generally is of sheet steel, with cast steel supports and gun-metal fittings, although when specially called for the ventilators are made of copper, with gun-metal turntables, &c. In all cases the turntables are fitted with ball bearings.

The "A. and A." Electric Radiator.

A successful attempt to depart from the usual "standard" lines of electric heaters has been made recently by the A. & A. Electrical Co., Ltd., 13, Farringdon Road, E.C. 1. The "A. and A." electric radiator (fig. 3) is designed with excellent taste, and can be placed in the centre of a room without detracting from the room's appearance. It is very light in construction, the frame being of aluminium and the case of light sheet metal. Owing to this, less heat is expended in raising the temperature of the apparatus itself. The elements, which have a range of from 250 to 750 watts each, are of nickel-chromium wire spirals carried in silica tubes. Being inserted in clips they are easily removable or replaced. The radiators are constructed with either two or four bars. The four-bar type has two bars controlled by a switch on the radiator and two by the wall plug switch, thus complying with the standard regulations. Very strong hot air currents are set up by this heater, as we had an opportunity of testing. The radiator is finished in six separate styles by a special process—oxidised silver, bronze vert, old gold, dull copper, dull gold copper, and dull copper bronze.

A New Siren.

A siren with a reverberating note similar in tone to the fog signals familiar to British shipping is the "City" siren. It is constructed upon the same principle as the larger fog and harbour signal, and has a wide field of application in aerodromes, docks, factories, shipyards, &c., as a time signal and fire alarm.

It consists of a cast aluminium fan mounted on the spindle of a vertical motor running at a speed of approximately 2,000 r.p.m. This fan draws in air vertically and expels it horizontally through specially designed ports. The weather-

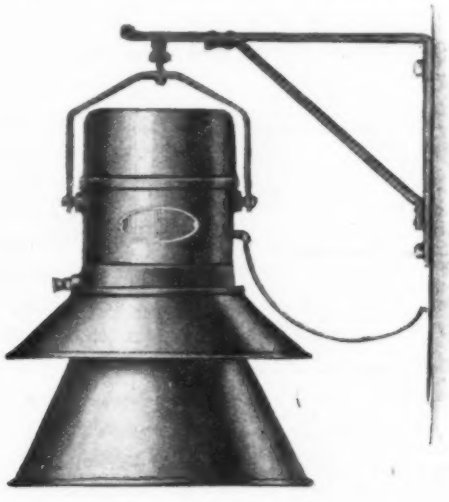


Fig. 2.—The "City" Siren.

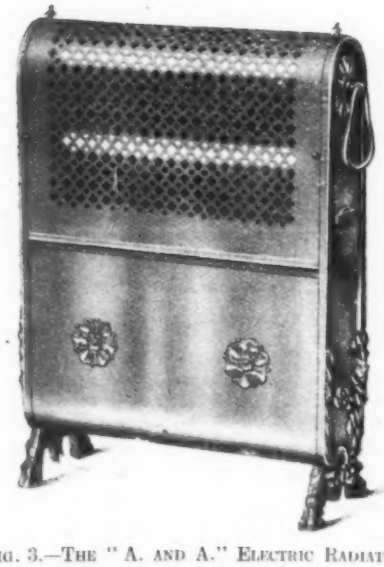


Fig. 3.—The "A. and A." Electric Radiator.

proof case in which the whole is mounted is fitted with a skirt so shaped as to distribute the sound waves towards all points of the compass as will be seen from the illustration (fig. 2).

The motor shaft is mounted upon a ball thrust bearing, and constitutes the only working part. The whole siren is of robust construction, and entirely suitable as a piece of apparatus that gets a minimum of attention. It is made for 110 or 220 volts, A.C. or D.C., ½-H.P.—1-mile type, ¼-H.P.—2-mile type, by the City Electrical Co., 1, Emerald Street, London, W.C. 1.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

29,331. "Brush holders of dynamos and motors." A. H. Avory, G. Kent, Ltd., and D. R. Pistor. October 18th.

29,335. "Automatic telephone systems." Automatic Telephone Manufacturing Co., R. Mercer, and P. Webster. October 18th.

29,378. "Dynamo electric generators for lighting cycles, &c." J. R. Middleton and W. Williams & Co. October 18th.

29,380. "Electrical apparatus." E. L. W. Byrne. October 18th.

29,381. "Apparatus for receiving and reproducing sound." A. F. R. Cotton and E. W. C. Russell. October 18th.

29,383. "Electric indicator boards, &c." E. G. Eriksson and K. G. Jonasson. October 18th.

29,407. "Thermally actuated switches." P. W. Baker. October 18th.

29,416. "Manufacture of regenerated electric incandescent lamps." F. Voglhut. October 18th. (Germany, October 17th, 1919.)

29,436. "Portable electric lamps." G. Oldham and J. Oldham. October 18th.

29,461. "Portable electric lamps." W. H. Shannon. October 19th.

29,473. "Electrical fittings." F. F. Smith. October 19th.

29,479. "Telephone switch separators." Dictograph Products Corporation and E. W. Pattison (Dictograph Products Corporation). October 19th.

29,499. "Combined telephone ear-tubes and ear-caps." R. L. Murray and Telephone Manufacturing Co. October 19th.

29,515. "Means for generating high-frequency electric oscillations." P. P. Eckersley and H. J. Round. October 19th.

29,527. "Wall electrical plugs." A. Ten Bosch. October 19th. (Holland, July 23rd, 1919.)

29,529. "Electric locomotive cranes." P. A. H. Mossay, Mossay & Co., and Ransomes, Sims & Jefferies. October 19th.

29,530. "Device for testing electric ignition of internal combustion engines." V. F. M. Oliver. October 19th.

29,540. "Manufacture of stator and rotor laminations for dynamo-electric machines." J. Maina and P. H. Pilatus. October 19th.

29,562. "Electrically operated horns." M. F. L. A. Aymard. October 19th.

29,564. "Automatic timing switch for motor cars." A. G. Cramp and J. Wilkinson. October 19th.

29,600. "Mechanism for providing feed holes to paper tape of telegraph perforating instruments." A. S. Willmot. October 20th.

29,608. "Electric pocket lamps." C. Boltshauser and Cosmophos-Werke Akt.-Ges. October 20th.

29,639. "Search lights, &c." E. Bennett and Sir C. A. Parsons. October 20th.

29,640. "Manufacture of electric furnaces and ovens." A. Selvatico. October 20th.

29,646. "Relay transmitters." Sperry Gyroscope Co. October 20th. (United States, October 20th, 1919.)

29,649/50. "Hydro-electric apparatus." M. Payne. October 20th.

29,658. "Electrical resistances." C. Oliver. October 20th.

29,668. "Interrupting devices for electric circuits." Metropolitan-Vickers Electrical Co. October 20th. (United States, November 6th, 1919.)

29,701. "Method of utilising peat or turf for heating and for generating steam, electricity, or gas." J. Worthington. October 21st.

29,703. "Electrical switches and fuses." Midland Electrical Manufacturing Co. and H. E. Sutherland. October 21st.

29,707. "Telephone systems." Automatic Telephone Manufacturing Co. and J. Savin. October 21st.

29,731. "Measured service telephone systems." Automatic Telephone Manufacturing Co. October 21st. (United States, December 13th, 1919.)

29,733. "Terminals for electrical coils." H. J. Felstead. October 21st.

29,738. "Emergency brake mechanism for tramcars, &c." G. E. Goldspink. October 21st.

29,780. "Electric furnaces." E. L. Smalley. October 21st. (United States, October 21st, 1919.)

29,783. "Secondary cell containers." F. P. Fletcher. October 21st.

29,811. "Distributors for high-tension ignition apparatus." E. A. Watson. October 21st.

29,844. "Electric switches." G. Oldham, J. Oldham, and O. Oldham. October 21st.

29,851. "Plug and socket-like connectors for flexible electric leads." A. T. Padmore. October 22nd.

29,852. "Electric heaters for kettles, &c." A. T. Padmore. October 22nd.

29,856. "Controllers for electric vehicles." W. Rogers and Wingrove and Rogers. October 22nd.

29,861. "Sparking plugs." Beru-Werk. October 22nd. (Germany, August 14th.)

29,878. "Switch levers for railways, tramcars, &c." A. Cameron. October 22nd.

29,891. "Sparking plugs." O. Meissner. October 22nd. (Germany, June 11th.)

29,901. "Electric water-heater." J. F. Barr. October 22nd.

29,903. "Sparking plugs." A. W. Armstrong. October 22nd.

29,929. "Radio-goniometry." H. Abraham and M. Philippson. October 22nd.

29,931. "High power conductors for transmission of high-frequency oscillations for telegraphy and telephony." Ges. fur Drahtlose Telegraphie. October 22nd. (Germany, December 1st, 1919.)

29,951. "Automatic switching apparatus." Landis and Gyr-Akt.-Ges. October 22nd. (Switzerland, October 24th, 1919.)

29,952. "Sparking plugs." C. Chollet and G. Lepape. October 22nd. (France, October 22nd, 1919.)

29,957. "Sending devices for radio-telegraphic stations." P. J. Laüt. October 22nd. (France, October 23rd, 1919.)

29,962. "Cooling electrical machines." L. R. Morshead and W. M. Selvey. October 22nd.

29,988. "Self-contained electric time pieces, &c." M. J. Browne. October 23rd.

30,002. "Drop electric lamps." H. E. Hadwen and H. Willis. October 23rd.

30,024. "Electric heating apparatus." E. J. V. Earle and J. J. J. M. Kluijtmans. October 23rd.

30,025. "Switches, relays, contactors, &c." R. Amberton. October 23rd.

30,028. "Means for protecting alternating electric current systems and apparatus." H. Pearce. October 23rd.

30,042. "Method of producing electricity." W. J. Robinson. October 23rd.

30,051. "Switches for electric installations." A. Graf. October 23rd. (Germany, January 26th.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

21,226. "Sparking plug." Jarvis & Ryder. October 20th, 1914.

1918.

11,125. "Electrical torpedo nets." A. Hedina. March 6th, 1918. (151,658.)

1919.

8,573. "Insulated electrical conductors." British Thomson-Houston Co. (General Electric Co.). April 4th, 1919. (151,667.)

14,559. "Electric batteries." R. C. Houston. September 19th, 1919. (151,680.)

14,858. "Sealing-in machines for electric lamp bulbs." British Thomson-Houston Co. (General Electric Co.). June 12th, 1919. (151,682.)

15,474. "Electromagnetic apparatus." G. C. Cummings. June 19th, 1919. (151,690.)

15,755. "Electric gramophone drive." F. Myers. June 23rd, 1919. (151,696.)

16,088. "Electrically heated liquid heaters." C. H. Lauth. June 26th, 1919. (151,710.)

16,089. "Electrically-heated liquid heaters." C. H. Lauth. June 26th, 1919. (151,711.)

16,091. "Electric ovens for cooking purposes." C. H. Lauth. June 26th, 1919. (151,712.)

16,230. "Electric incandescent lamps." British Thomson-Houston Co. (General Electric Co.). June 27th, 1919. (151,721.)

16,373. "Appliance for inserting at will within certain electric circuits a switch or control or other apparatus." D. P. J. Kelly. June 30th, 1919. (151,729.)

16,876. "Coupling for electrical conduits." J. Jagger, W. Jagger, and W. B. P. Jagger. July 5th, 1919. (151,745.)

17,150. "Electrical ignition systems of internal combustion engines." G. A. Edwards. July 9th, 1919. (151,751.)

17,479. "Electric display sign." C. Treguning. July 12th, 1919. (151,759.)

17,494. "Tools for electric riveting and spot welding." T. J. Shea. September 24th, 1918. (133,024.)

18,003. "Electric boiler." E. Piquerez. October 4th, 1918. (133,290.)

18,830. "Electric switches." E. J. Harman and E. Le Bas. July 29th, 1919. (151,773.)

18,964. "Electric heating apparatus." Automatic Telephone Manufacturing Co., C. H. Archer, and G. W. Simister. July 31st, 1919. (151,778.)

19,905. "Removable electric fuse carriers." W. T. Henley's Telegraph Works Co. and W. S. Wakefield. August 13th, 1919. (151,787.)

20,883. "Multiple filament electric incandescent lamps." D. Lely and Naamloose Vennootschap Philips' Gloeilampenfabrieken. August 25th, 1919. (151,802.)

22,319. "Means for starting up synchronous rotary converters and other electrical machines of a like character." Electric Construction Co. and W. Tonkinson. September 11th, 1919. (151,810.)

23,553. "Apparatus for actuating an electric switch or indicator by the application of predetermined numbers of impulses." H. E. Angold. September 24th, 1919. (151,818.)

27,433. "Wave lengths or frequency indicators for wireless circuits." N. Lea and Radio Communication Co. November 6th, 1919. (151,848.)

32,517. "Method and apparatus for duplex cable signalling." L. Cohen. December 29th, 1919. (151,871.)

32,793. "Electrodes of electrolytic gas generators." I. H. Levin. December 31st, 1919. (151,873.)

1920.

444. "Electrically controlled combustion system for ignition and burning liquid fuels." T. L. R. d'Orville. January 6th, 1920. (151,876.)

5,720. "Adjustable setting lever for electric ignition devices." R. Bosch Akt.-Ges. March 11th, 1919. (140,062.)

8,715. "Electric fuses of the enclosed type." V. E. Joyce and Park Royal Engineering Works. March 24th, 1920. (151,903.)

8,892. "Means for catching and removing oil from the bearings of rotary electric machines." K. Nobuhara. March 26th, 1920. (151,904.)

10,844. "Microphone mountings." R. L. Williams. April 23th, 1918. (142,096.)

14,509. "Armature mounting for electro-magnetic apparatus." G. C. Cummings. June 19th, 1919. (Divided application on 151,690.) (151,912.)

16,183. "Apparatus for directed wireless telegraphy and telephony." E. Bellini. November 4th, 1916. (Addition to 22,879/14.) (145,049.)

17,581. "Diaphragms for submarine signal transmitters." Atlas Werke Akt.-Ges. July 20th, 1918. (146,253.)

The Helium Arc.—Mr. G. M. J. Mackay, of the research laboratory of the General Electric Co., of America, states in a letter to *Science*, that helium as a conducting medium for a low-voltage arc may be of considerable utility as a convenient source for generating, from direct current, oscillations of moderately high frequency. Due to its exceptionally low sparking potential arcs may be readily started from a hot tungsten cathode by 110 volts even when the gas is at atmospheric pressure. In fact it is easy to start the arc across a centimetre gap between cold electrodes by means of breaking a parallel circuit with a series reactance common to both. Perhaps a more convenient method of starting, however, is the heating of the filament by the source of supply and then a commutation of the connection to the positive terminal from the filament to the anode. When the proper inductance and capacity are connected across the arc high-frequency oscillations are produced which may be utilised in the usual way with a coupled circuit. Hitherto, hydrogen and compounds of hydrogen have been used in arcs to produce high frequency, and it is very difficult to produce oscillations by the use of other gases at atmospheric pressure. Helium, however, probably due to its high heat conductivity, being inferior only to hydrogen in this respect, from the rapid rate of energy dissipation in the arc, gives the type of volt-ampere characteristic which is necessary for the production of the A.C. From a 6-ampere arc in helium at approximately atmospheric pressure, and with a centimetre gap, 50 watts or more of A.C. at 1,000 cycles may readily be obtained.